The Welding Engineer

NOVEMBER, 1945

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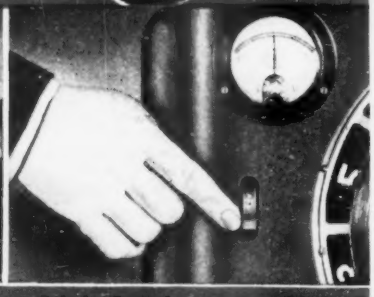

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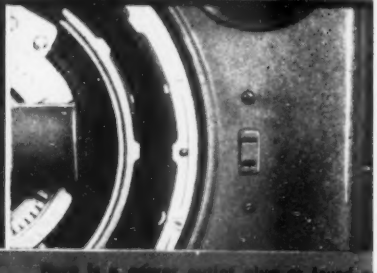

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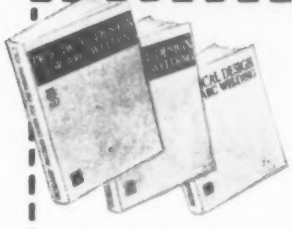

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★ INSPECTION

Methods of Magnetic Inspection

One of the chief metal-working developments of the war was the widely used magnetic-particle inspection. This article gives its theory and practice and tells how it is being made to reveal invisible welding flaws.

By **FRED M. BURT**

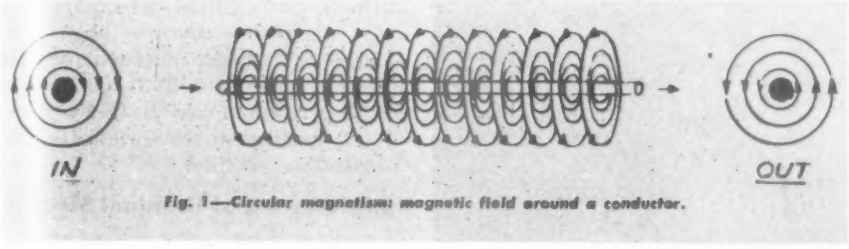


Fig. 1—Circular magnetism: magnetic field around a conductor.

TWENTY-EIGHT years ago Major William E. Hoke of the Bureau of Standards was watching the lapping of precision blocks held by a magnetic chuck. He noticed that cracks could be revealed by the groupings of attracted magnetic particles. Further research developed the longitudinal magnetic-inspection method, which was used for several years in a rather restricted field on such items as railroad equipment axles, turbine blades, etc.

Progress Prior to Pearl Harbor

In 1928 the technique received a new impetus when Dr. A. V. DeForest of Massachusetts Institute of Technology, searching for a satisfactory method of locating longitudinal defects in drill pipe, developed the use of circular magnetism. Later the Army Air Force Matériel Branch at Wright Field became a major factor in bringing this inspection process to its present standard. Recommended standards were not published until they appeared in the 1941 SAE Handbook. Since that time the use of this technique has had a wide acceptance.

Magnetic inspection is non-destructive, easy, fast and inexpensive. The test can be applied to billets, bar stock, forgings, castings or to finished parts. Defects inherent in the metal, defects developed in manufacturing processes and defects caused by the various vibrations and strains of service are quickly and plainly shown up.

Two Kinds of Magnetism

We all know that if a number of turns of insulated wire are wrapped around a soft iron bar and an electric current passed through the wire, lines of natural force (flux) will flow through the bar. This is longitudinal magnetism and will attract small iron filings to the bar. Now if these lines of magnetic force are caused to flow through a piece of steel, they will be obstructed or distorted by any transverse flaws—those not parallel to the flow. The resulting leakage field sets up a "discontinuity" of flow. The crack or other flaw will acquire north and south poles of its own and act as a miniature magnet, attracting the iron oxide magnetic powder washed over the surface. The fine particles bridge from pole to pole to form an "indication," which will be sharper and plainer the nearer the discontinuity is to the surface and the greater the strength of the magnetic lines of force.

The electric current may be passed through the iron or steel bar instead of through a coil surrounding it. The flux then produced flows in closed circles around the current (circular magnetism). With the equipment used in magnetic testing, it is possible to produce these lines of force in any piece, controlling the intensity and direction. Figs. 1, 2 and 3 illustrate the basic principles of circular and longitudinal magnetism.

Magnetic inspection was brought to a high degree of efficiency at Lockheed Aircraft Corp., Burbank, Calif., for fast work in small and large quantity testing. Rigid requirements for top quality were laid down for the analyses. The excellence of the equipment used and the standardization of methods both contributed to provide a proper procedure for any part to be inspected.

Circular Magnetism

Lockheed uses both the circular and the longitudinal methods. The machines used in the circular method (Fig. 4) look like vise jaws of welded steel construction. Two heads carry lead-faced, copper contact plates. One plate is fixed; the other is movable on horizontal rails to which it can be locked. The piece to be checked is secured between the two heads, and a high-amperage, low-voltage direct current is passed through the part for

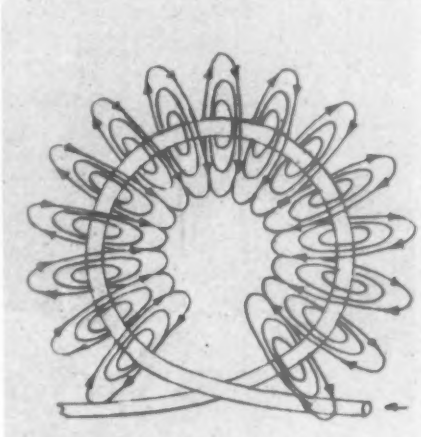


Fig. 2—Longitudinal magnetism: conductor bent in a loop.

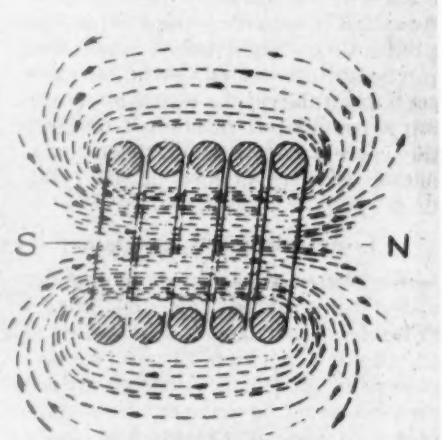


Fig. 3 — Longitudinal magnetism: magnetic field around a solenoid.

Fig. 4—Circular magnetization of a welded part by the continuous method. The part is held between lead-faced copper contact plates, one movable (rear) and one fixed.

about ½ second. The magnetic field then builds up as illustrated in Fig. 1.

Any crack or other discontinuity, at any angle to the lines of force, acquires north and south poles with a magnetic arc between them. The magnetic-indicating substance bridges this arc. Black iron oxide has been found to be the most serviceable material for this purpose. The particles are suspended in a base oil contained in a sump, around which the machine is built. The iron oxide makes up 1 to 1¾% by volume of this mixture. The oil is constantly agitated and kept in circulation by two electric pumps. The parts to be tested are sprayed with a nozzle on a hose attached to the pumping circuit.

The discontinuity is outlined in black with the oxide mentioned. Sometimes red iron oxide is used to produce a red outline. Solid bars of iron or steel can readily be tested. A hollow part such as a tube can be tested by inserting a copper rod through it to carry the current (Fig. 5); circular magnetism is then induced in the cylindrical walls.

Longitudinal Magnetism

The longitudinal method employs a coil or solenoid (Fig. 5) that is movable on rails and can be locked in the desired position. The parts are placed in this coil, through which direct current is passed for a fractional part of a second. The high-amperage, low-voltage direct current induces a magnetic field at right angles to the flow direction (see Figs. 2 and 3). The molecules of the object to be magnetized are rearranged to form north and south poles as in the circular method. Similarly, the magnetic particles are attracted to form the "indication" determining the existence and nature of a flaw.

Longitudinal magnetizing is principally used to locate transverse defects such as are caused by forging operations, fatigue under repeated stress, heat treatment, machining, welding, grinding, etc. An indication developed by magnetic inspection of a motor mount weld is shown in Fig. 6.

The commonest flaws, generally present in all steels to some extent, are directed longitudinally, in the direction of rolling or forming. Usually, such faults, caused by manufacturing or processing operations, cannot be shown up by longitudinal magnetization, but the circular method, creating lines of force at right angles to these longitudinal defects, will locate practically any of them. And though the circular method may not indicate transverse flaws completely, it will give enough of an indication to direct further investigation by the longitudinal method.

Continuous and Residual Methods

In a majority of cases the inspection is conducted by the continuous method. The mixture of oil and magnetic particles in suspension is flowed over the part while the current is on. Then, just before the current is cut off, the flow is stopped to avoid washing off any fine indications. In this case, of course, the current is on much longer than the fraction of a second previously mentioned. The part can conduct a far greater number of lines of magnetic force than it can retain as a magnet, which it must be to use the residual method.

Fig. 5—The solenoid in the center background is used for longitudinal magnetism. The tubular parts being inspected (circular magnetism) are strung on the copper bar carrying the current. The man is washing the parts with the oil-based fluid while the lady in the background inspects them.

Dead soft iron or extreme low-carbon steels will not retain magnetism after the current flow stops. As steels increase in hardness, their capacity to retain magnetism also increases. Steel parts of hardnesses ranging from 25 to 40 Rockwell C will retain enough magnetism to permit the wash to be applied after the current is turned off, but only if the defects are on the surface or very close to it.

Current Rectification

The direct current, available to either the solenoid coil or the plates and used in both circular and longitudinal methods, comes from a rectifier unit. A 220-440 volt, 3 phase, 60 cycle alternating current enters the rectifier through a line switch to a set of breakers actuated by push buttons through a timing-circuit. The current first passes through an autotransformer and a power transformer and is reduced to approximately 13 volts with amperages as high as 5,000. The high-amperage current then enters air-cooled, dry-disc rectifiers through which it can only flow in one direction, thus producing the desired direct current.

The movable contact head of the magnetizing unit is operated forward and backward with a tailstock driven by a reversing-reduction type motor. On another machine the head is of the pneumatic type, and the tailstock is movable by hand crank to set it for the size of the part to be tested. The headstock, mounted on a pneumatic piston, is then actuated with compressed air to receive or release the part very quickly. This type of machine is faster and cheaper to maintain than the electrical type.

Good contacts are assured by cleaning the contact plates of oxide coatings with a wire brush. The plates, of special Lockheed design, are antimony-lead, one in. thick; they have been in service over two years as contrasted with the previous bimonthly turnover of standard-type plates. The oxide magnetic-particle concentrations in the base oil start fresh with 1 to 1¼ oz of black No. 7 or red No. 9 iron oxide pastes per gallon of oil. Strengths can be checked by collecting 100 cc of mixture from the nozzle flow in a 100 cc graduated glass tube. The mixture is demagnetized and allowed to settle for an hour or so. The cubic centimeters of oxide collected in the bottom of the tube will then tell the percentage of the solution.

Demagnetization Methods

Demagnetization, the process of neutralizing or taking away the magnetic field, is conducted in the regular production line (Fig. 7). It is not necessary to demagnetize parts to be heat treated, since iron and steel lose their residual magnetism at about 1,400 F. However, parts to be machined or that go directly into assembly must be demagnetized, and this is done not only in the magnetic inspection department but in other stations throughout the factory. The importance of demagnetization to aircraft manufacture can scarcely be overemphasized. A plane, depending on its compass as the chief instrument of navigation, might be in for serious trouble if errors in compass reading occurred because of a magnetized part. Thus great care is taken that such mishaps will not occur. If a magnetized part does slip through, portable demagnetizing units are on hand at bases to clean up these "hot spots" after they are found, sometimes after a very long, tedious job of searching.

Several methods are used for demagnetization, depending on the part and where the work is done. One method is to pass an alternating current, at line or special frequency, through the part and slowly reduce it to zero current. Direct current may be used if its direction of flow is reversed by switching the leads on their terminals.

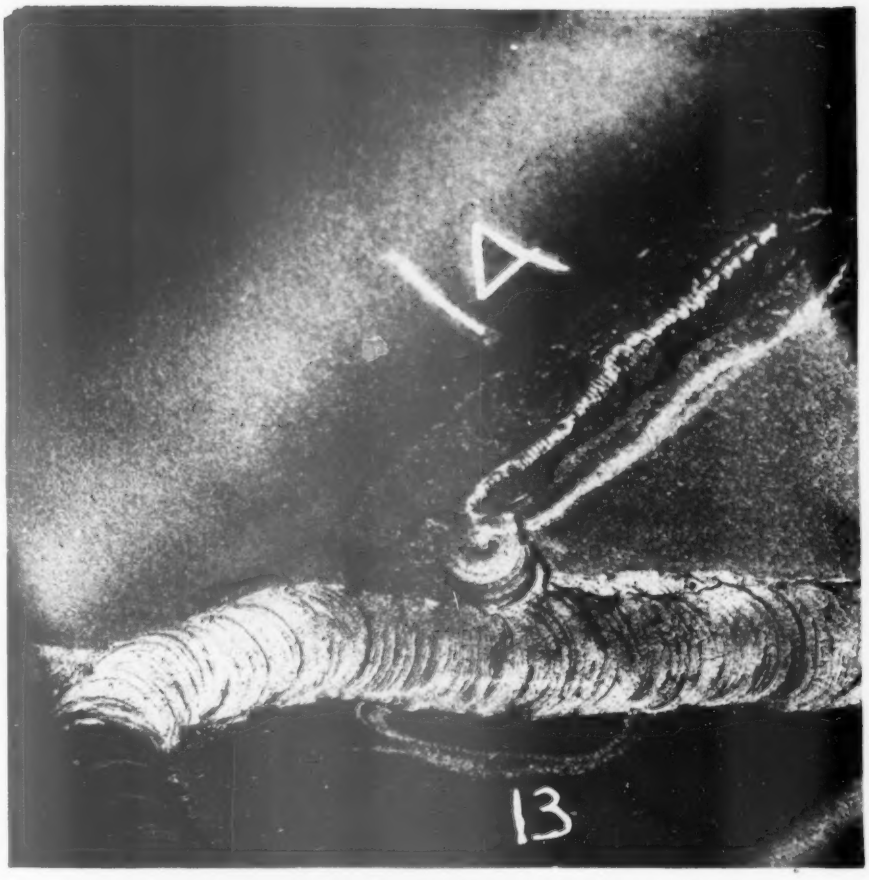


Fig. 6—Indications developed by magnetic inspection in welds on a motor mount.

A special unit is used to demagnetize armor plate on a production basis; a large table-top demagnetizer (Fig. 8) is used on motor mounts, bays, landing gears, etc., and small parts are carried by conveyor belt through a solenoid for continuous demagnetization.

Weld Defects Detected

The majority of the defects revealed by magnetic inspection at Lockheed fall in the following categories:

Inclusions. These are particles of impurities — oxides, sulphides, silicates, improperly finished bath slags, dirt from ladles and molds. All of these non-metallic inclusions are normal byproducts of steel-making. They are not as detrimental as cracks and are often of little importance. They are undesirable, however, because they break up the continuity of the metallic base.

Laminations may be defined as fibrous inclusions. Laminated tubing has a tendency to open up under welding heat and is not always sealed over by the weld puddle, often causing the base metal to crack; also the lamination may contaminate the weld metal and cause it to crack. Laminations in tubing should be dressed out.

Laps are surface defects caused by folding over hot metal fins or sharp

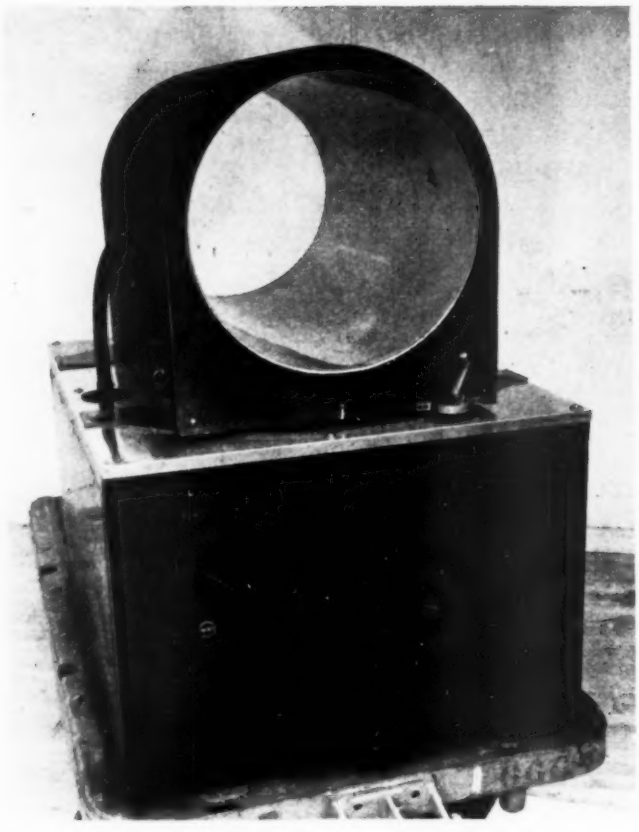


Fig. 7 — Demagnetizer unit used in precision assembly of engine control stands, rudder torque tubes, etc. A maximum current of about 100 amp (a-c) is reduced to zero by a water rheostat controlled by foot.

corners and then rolling or forging them into the surface without welding them to it.

Seams (see Fig. 9) are similar in appearance to laps. In steel manufacture, blowholes towards the outside of an ingot always contain iron oxide and will not weld together when the metal is rolled; seams result.

Forging cracks. The forging of steel too drastically at too low a temperature causes irregular jagged cracks of (usually) considerable depth. **Bursts** are large forging ruptures in the interior of the part. **Flakes** are small fractures scattered throughout the interior and caused by improper cooling.

Grinding cracks are caused by localized heating and cooling of the surface during grinding. They are short and may be either straight or slightly curved. Open to the surface but tight-lipped.

Straightening cracks are incurred in the process of straightening. Welded assemblies often develop cracks after straightening and should, therefore, be inspected after every straightening or bending operation.

Thermal cracks result from too rapid heating, too drastic a quench or any non-uniform heat treatment. These cracks are deep, generally with the appearance of a seam. They are a common product of welding done with excessive heat (Fig. 10).

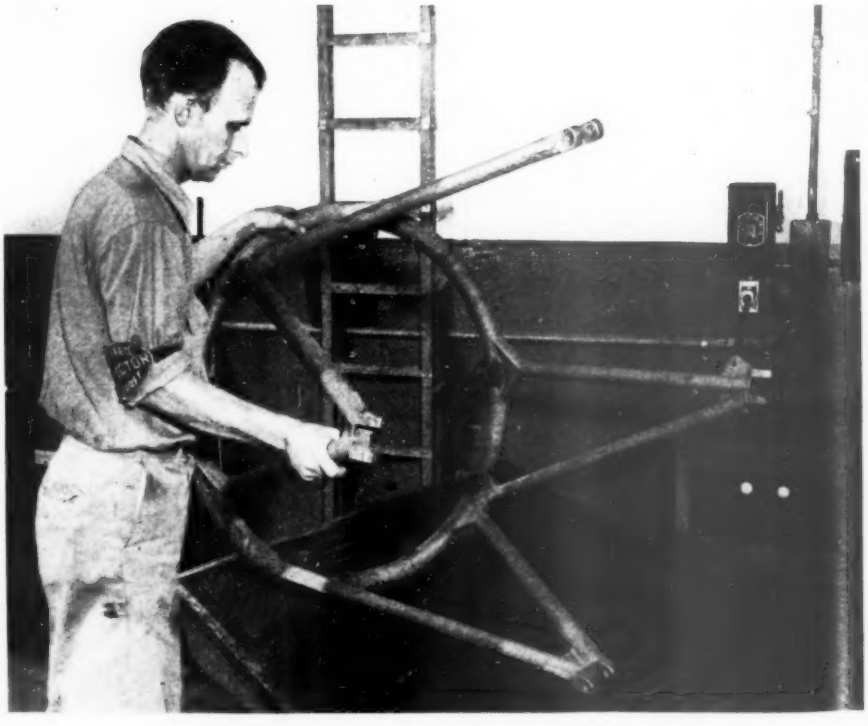


Fig. 8—Table-top demagnetizer being used on a motor mount.

Overheating, unusual but serious, may take place during forging. At 2,200 F and above, a small portion of the metal melts and loses coherence with the solid remainder. Hence the metal will crack or break in brittle fashion when the molten portion cools.

Crater cracks may come from the craters formed at any point from which the weldor removes his arc or torch. A small crack in the crater is not harmful as it will invariably remain trapped.

Lack of penetration, failure of the weld metal to penetrate the base metal, results from too fast a welding speed and/or inadequate flux. The flux must dissolve the oxide scale caused by weld heating.

Weld-Zone Characteristics

A further consideration of some fundamentals of weld structure will show why extreme care must be taken in welding parts required to pass a rigid magnetic inspection. The ideal weld would be one with no discontinuity where the weld and parent metals join because both metals have the same composition and structure. This condition is rarely if ever attained as the weld is a quickly cooled cast structure and necessarily dissimilar to the base metal. However, great strides towards the ideal uniform structure have been realized through the careful choice of rods, fluxes, welding procedures and postweld treatments.

Every welded joint has four zones of different characteristics. The first of these is the "deposited metal" zone in the center; this is a cast, crystalline structure of weld metal, deposited in the joint and cooled from the outside towards the center. This zone is not to be confused with the "fusion" zone.

The second or "fusion" zone is a coarse-grained structure located on either side of the deposited metal zone

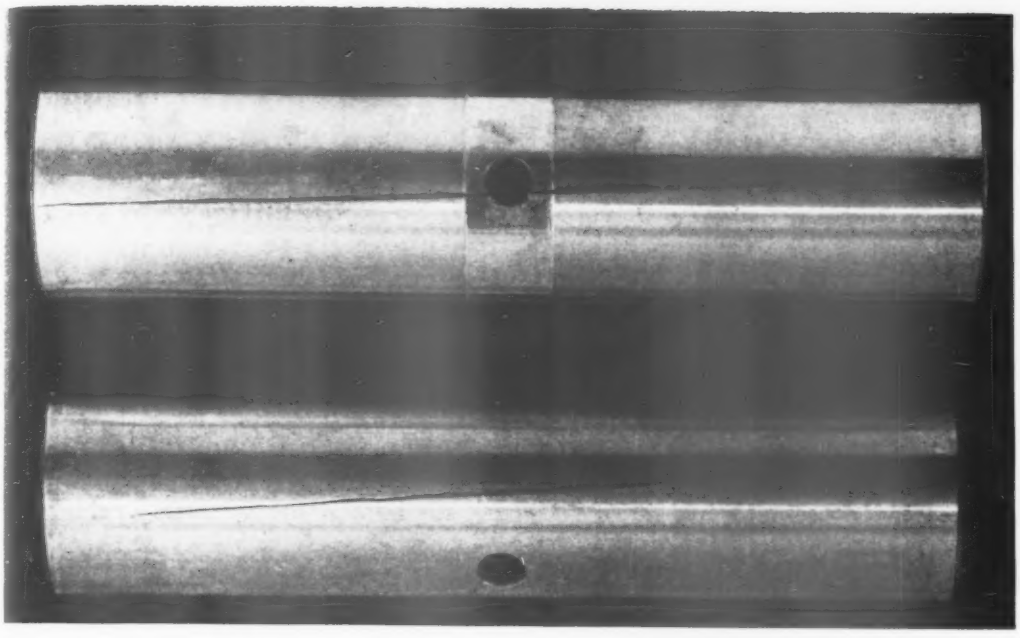


Fig. 9—Longitudinal seams in chromium plated (upper) and unplated pins. A stress analysis determined that the conditions of loading would not be affected by these seams, which would constitute a detrimental effect in some other parts.

and wherever the weld metal fuses with the parent metal.

The third or "refined" zone is on the outside of each fusion zone and has a grain structure even finer than that of the parent metal because of its refinement by heating and quick cooling.

The fourth or "unaffected" zone is the parent metal itself.

It may thus be seen that the crystalline structures of the weld are not homogeneous with that of the parent metal. Greater homogeneity and relief of strains set up in the welded zone are obtained by heating the metal above the critical point and then cooling it in still air (normalizing).

Consideration of Design

Some of the design considerations developed by Lockheed experience are listed in the following paragraphs. They apply mainly to arc and oxy-acetylene welding.

1. Surface cracks will develop if welds are made along bends.
2. Welds should not be made on both sides of thin sheets.
3. Straight tension welds have a weakening effect. Fishmouth joints should be used to put part of the weld in shear and increase the length of the weld.
4. Long tapers or wrap straps to give a smooth change of section diameter should be used to avoid stress concentration.
5. Scarf splices as well as fishmouths should be used. These put the weld in shear and the member carries the axial load.
6. Welded parts not normalized will develop cracks in service, especially if they are subjected to vibrational stresses.

Some Pertinent Definitions

Ampere-Turn. The number of amperes flowing multiplied by the number of turns of wire.

Coercive Force. The reverse magnetizing force necessary to demagnetize the part.

Dimagnetic. Non-magnetic. This includes glass, wood, copper, lead, etc. (See also "ferromagnetic" and "paramagnetic").

Ferromagnetic. Capable of becoming magnetized. Ferromagnetic substances are iron, steel (except austenitic steel), cobalt and nickel. (See also "paramagnetic").

Flux Density. Strength of the magnetic field.

Induced Magnetism. The magnetizing of a part by its presence in a magnetic field (longitudinal magnetization in a coil). Parts may also be circularly induced when threaded on a rod.

Magnetomotive Force. The magnetizing force set up by a current flowing through a coil of wire (solenoid). Its unit is the ampere-turn.

Paramagnetic. Not magnetic but allowing free passage of magnetic lines of force. Austenitic steel is an example. (See also "ferromagnetic" and "dimagnetic").

Permeability. The ratio of the flux density in the substance to the intensity of the magnetic field.

Permeance. The degree of ease with which magnetic lines of force may pass through a magnetic substance.

Reluctance. The degree of difficulty in producing the magnetic flux; *i. e.*, the resistance to the passage of magnetic lines of force through a magnetic substance.

Retentivity. The ability of the part to retain magnetism after the current is shut off.

Solenoid. Any number of loops of wire around a suitable frame.

Fig. 10—A subsurface crack on a welded part as indicated by magnetic inspection.

Ideas that Meant Dollars

Suggestion contests may or may not yield good results, depending on how they are handled. This one at Kaiser's Vancouver yard was one of the most successful from the standpoint of fruitful ideas for welding improvement.

Fig. 1—These cards were placed over suggestion boxes throughout the yard.

WHAT is believed to be the most successful suggestion contest of its kind ever conducted ran for a period of one month and brought in scores of practical ideas for improvements in welding production—ideas which would save an estimated $26,000 monthly and 11,000 man-hours for the same period. The program, designated as the "Arc-Welding Achievement Award," was sponsored jointly by the Portland, Ore., branch office of the Lincoln Electric Co. and Kaiser Co., Inc., Vancouver, Wash.

The contest, eligible to all workers at the Kaiser-Vancouver shipyard, was divided into five different groups. The winner in each group received a $100 war bond and a handsome bronze plaque. In addition, 33 honorable mention certificates were also awarded to participants. The separate divisions consisted of weldor journeymen, weldor leadmen, weldor foremen, weldor supervisors and crafts classed as miscellaneous.

The Five Prize Winners

The prize-winning ideas, chosen for their effectiveness in improving quality, eliminating waste and increasing production, consisted of the following five good suggestions:

(1) Equip all flame-cutters with slag hammers to clean the slag from their cuts. The previous practice was to leave this task for the weldors. Often by the time the weldor reaches a cut to start work, it is impossible for him to get at the slag to remove it, and this results in an inferior weld—*August M. Knutilla, day weldor.*

(2) Change the method of welding access insert plates. The insert should be faired in place by dogging and allowed to stay in floating position. Then two weldors should work simultaneously, using the "Twin Arc" method—*William B. Brown, day weldor foreman.*

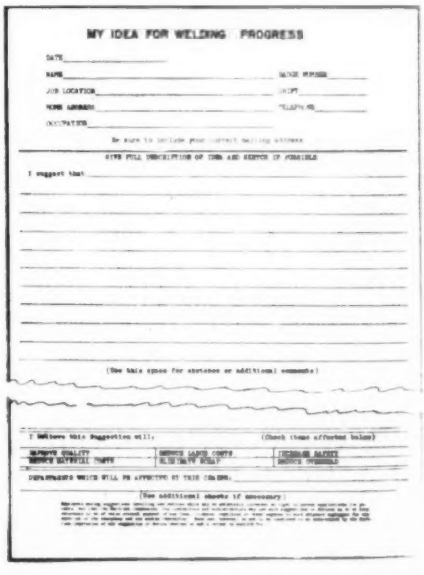
(3) Reduce the stress brought about in plates of ⅜ in. and less where small electrodes and slow welding are used. Larger electrodes should be used, and the plates left unbeveled and welded rapidly. This will decrease the area affected by stress caused by heat—*R. V. Winchell, assistant superintendent in assembly.*

(4) Plug and slot welds should be left with straight sides, eliminating the necessity for countersinking to a ⅛ in. land. This makes for cleaner welds. As large an electrode as possible should also be used—*Jerry Gunther, assistant superintendent of hull material.*

(5) Use a special type of electrode in hand welding deck butts and seams. The use of that type of electrode has been avoided because it requires excessive current, and the high amperage causes "hot stingers" which must constantly be repaired. Use is suggested of a short, solid wire extension approximately a foot long. This will keep heat far enough from the electrode holder so that the operator may use any desired amperage over long periods of time without difficulty—*Warren Downing, swing weldor foreman.*

Suggestions for Suggestions

The interest of yard employees was aroused by an intensive promotional campaign carried out during the entire program period. Large placards were placed throughout the yard and cleverly worded cards (Fig. 1) appeared on the various suggestion boxes, while news of contest developments was carried in the Kaiser yard


MY IDEA FOR WELDING PROGRESS

DATE_____

NAME_____ CLOCK NUMBER_____

JOB LOCATION_____ SHIFT_____

HOME ADDRESS_____ TELEPHONE NO._____

OCCUPATION_____

Be sure to include your correct mailing address

GIVE FULL DESCRIPTION OF ITEM AND METHOD IF POSSIBLE

I suggest that_____

(Use this space for sketches or additional comments)

I believe this Suggestion will: (Check those affected below)

REMOVE QUALITY TROUBLE DIFFICULTIES	REDUCE LABOR COSTS ELIMINATE SCRAP	INCREASE SAFETY REDUCE OVERHEAD

DEPARTMENTS WHICH WILL BE AFFECTED BY THIS CHANGE:

(Use additional sheets if necessary)

Fig. 2—The suggestion blank used by employees. Note that the employee is asked to state the object of his suggestion—to improve quality, reduce material costs, reduce labor costs, eliminate scrap, increase safety or reduce overhead.

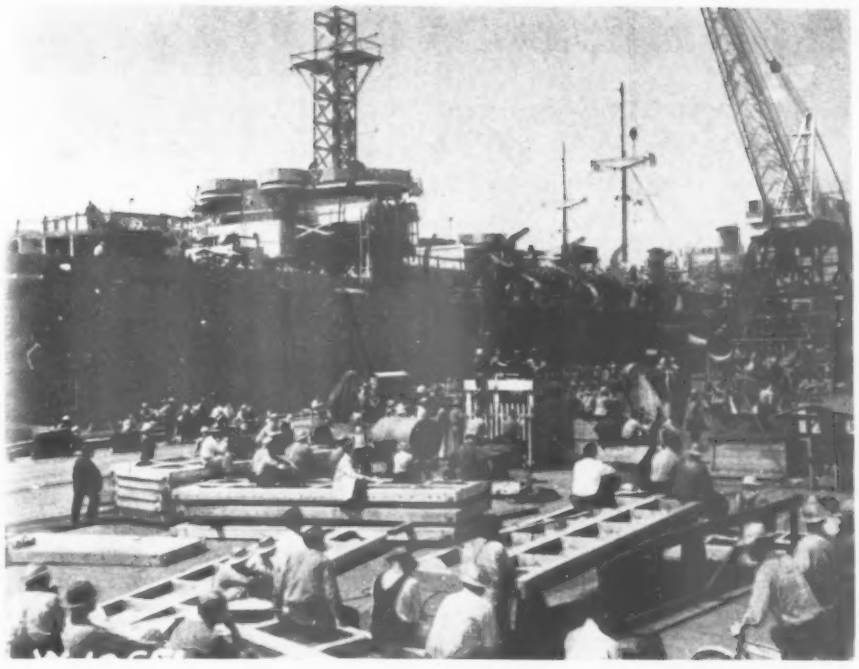


Fig. 3—Presentation ceremonies were made during the noon hour at the Vancouver yard outfitting dock.

paper, *Bosn's Whistle*, and in special bulletins to individual groups. Included with the suggestion idea blanks for entrants (Fig. 2) was a comprehensive list of suggestions for arriving at improvements. This said in part:

"Question every detail with these types of questions: WHY is it necessary? WHAT is its purpose? WHERE should it be done? WHEN should it be done? WHO is best qualified to do it? HOW is the best way to do it? Also question the—

"Materials. Can better, less expensive or less scarce material be substituted? Can scrap from this job be used for another job? Have defects and scrap been reduced to a minimum?

"Machines. Is each operating at maximum capacity? Is each in good operating condition? Could better quality work be accomplished if they were serviced more regularly? Is the machine the best for this operation? Can use be made of the machine's or the operator's 'idle' time?

"Equipment and Tools. Are suitable equipment and tools available? Have they been supplied to operators? How about jigs, gauges, and fixtures? Are equipment and tools in the best possible location for the job to be done?

"Product Design. Could quality be improved by a change in design or specifications? Would a slight change in design save much time or materials? Are tolerances and finishes necessary?

"Safety. Is this method the safest way as well as the easiest? Does the operator understand all the safety rules and precautions? Has proper safety equipment been provided? Remember, accidents cause waste of manpower, machines and materials.

"Work Place. Are the number of handlings and distances traveled at a minimum? Is all available space being used? Are aisles too congested? Is everything in the proper work area?"

Presentation Ceremonies

Presentation of the awards was made at an appropriate ceremony at the Vancouver yard outfitting dock during the noon lunch period. A general view of this assembly is given in Fig. 3, while the various prize winners and yard officials are shown in Fig. 4.

During the presentation ceremonies, the workers were lauded by D. S. Campbell, supervisor of shipbuilding at the yard, and G. L. Revell, district manager of The Lincoln Electric Co.'s branch office at Portland, Ore. Lieutenant Campbell, paying tribute to the sponsors and winners, said: "The winners of these awards are to be congratulated for their efforts in behalf of the shipbuilding industry. Many of your suggestions will find use not only in work here but also in the course of repair work, which is of parallel importance with new ship construction."

Mr. Revell, one of the members of the award contest committee, congratulated the yard workers on behalf of James F. Lincoln, president, The Lincoln Electric Co., and quoted some startling facts on the country's war production:

"It has been American ingenuity which has made it possible for a country representing less than 25% of the Allied population to furnish 75% of the total materials of war. It will be this same American ingenuity that must maintain our postwar economic position as the world's number one manufacturer."

Welding Footage Calculations

Though not included among the five prize winners, the suggestion of Roy A. Zeigler, junior engineer in production control, holds considerable interest for the readers of this publication and is therefore published in

(Please turn to page 50)

Fig. 4—A group of top winners and yard officials. Left to right: Jerry Revell, district manager of the Lincoln Electric Co.; William Russell, erection superintendent, Kaiser; Mr. Miller, assistant general manager, Vancouver; Warren Downing, swing weldor foreman; William Brown, day weldor foreman; Park Savage, outfitting dock superintendent; August Knutilla, day weldor; Jerry Gunther, assistant superintendent hull material; Ed Argersinger, superintendent of hull material; and Howard Denhart, superintendent in assembly.

Better

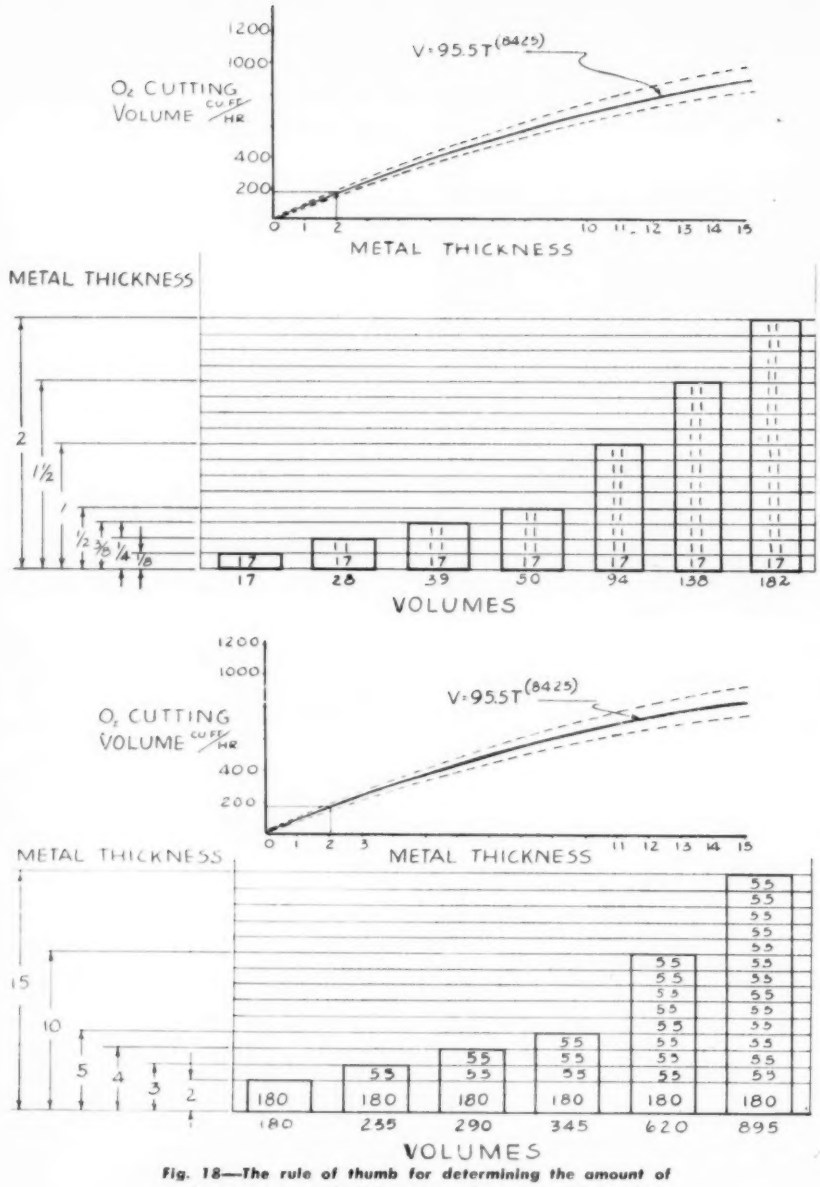


Fig. 18—The rule of thumb for determining the amount of cutting-oxygen required for plates from 2 to 15 in. thick.

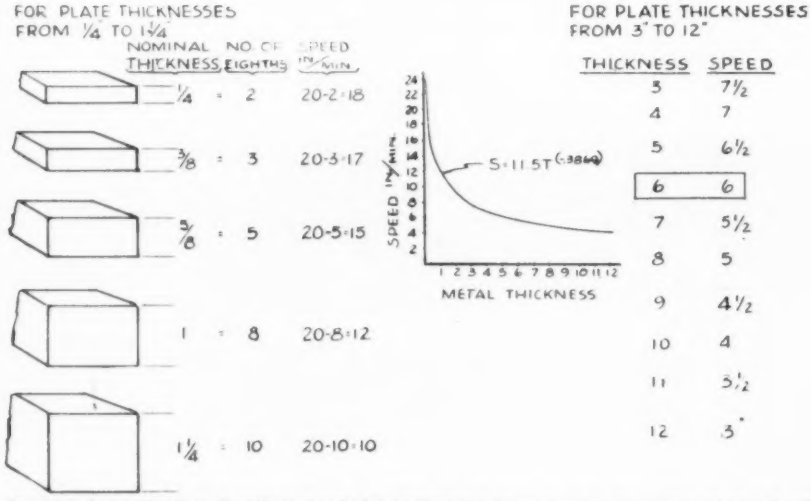


Fig. 19—Determination of cutting speeds by engineering formula and shop rules of thumb. A speed for a plate between 1¼ and 3 in. must be estimated by remembering that it will lie proportionately between 10 (1¼ in. thick) and 7½ (3 in. thick) inches per minute.

Fig. 17—The engineer's curve and formula (top) and a rule of thumb for determining the amount of cutting oxygen required for plates ranging from ⅛ to 2 in. thick.

Labor and material can very easily be wasted in shape-cutting if each particular job is not carefully analyzed and all factors taken into consideration. In September Mr. Chouinard discussed types of machines and tracing devices, when to build a template and when to use manual tracing, template storage and cutting-machine work tables. In October he took up the subjects of beveling plate edges, tip sizes and fuel-gas requirements, and multiple-cutting set-ups for small shapes and discs.—THE EDITORS.

THE relationship between the volumetric rate of cutting oxygen (in cubic feet per hour) and the thickness of the metal to be cut may vary somewhat depending upon the composition and cleanliness of the metal, cutting torch speed, local shop conditions, personnel, etc. However, the *average* value of this relationship is indicated by the solid curve drawn on the graph appearing in Fig. 17.

Equation vs. Rules of Thumb

This parabolic function is specifically for the average values. The equation $V=95.5T^{0.8425}$ means that the volume is equal to the constant 95.5 multiplied by the plate thickness in inches raised to the 0.8425 power. To anybody doing practical shop work, this formula is more than useless. It is practically impossible to raise a number to a fractional power without the aid of a table of logarithms or a log log slide rule. Even if the equation could be laboriously solved in the shop, it would still give only an average value.

A study of this equation shows that for all practical purposes it can be supplanted by two simple arithmetical relationships. The first of these relationships, for thicknesses up to 2 in., is shown in the block diagram in the lower half of Fig. 17. In this chart thicknesses are drawn as blocks ranging in height from ⅛ in. up to 2 in. If a stock ⅛ in. thick is being cut, the chart shows that approximately 17 cu ft of cutting oxygen per hour will be required, or, stated another way, the volumetric rate per hour of oxygen passing through the tip is 17 cu ft per hr. For each additional ⅛ in. of thickness, there will be required

Jobs from Flame-Cutting

★ Part Three—The third and final part of this helpful series on flame-cutting gives you the simple rules for quick calculation of cutting-oxygen volume requirements and cutting-speed settings for a given plate thickness.

By **A. F. CHOUINARD**
Research & Development Dept., National Cylinder Gas Co.

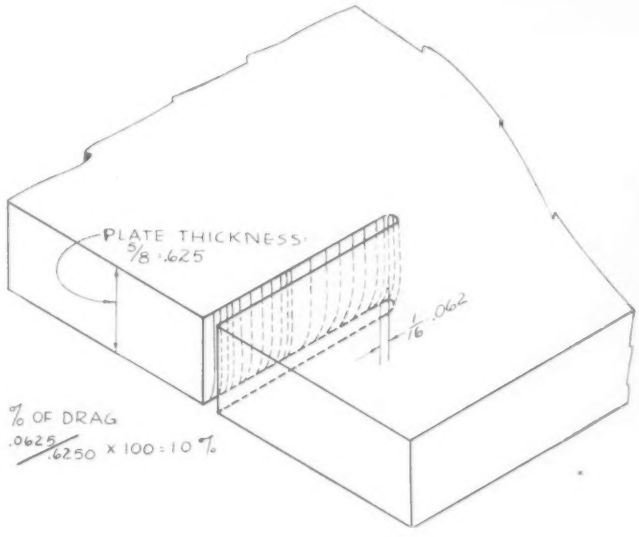


Fig. 20—Sketch depicting the effect of draglines on the cut edge of a 5/8 in. plate. The method of calculating the percentage of drag is given in the lower left-hand corner.

on an average, 11 additional cu ft per hr of oxygen. For example: ¼ in. thickness requires 17 cu ft per hr for the first ⅛ in., 11 for the second, a total of 28 cu ft per hr. For each additional ⅛ in., merely add 11 more cu ft per hr. Thus for ⅜ in. thickness, to the 28 for ¼ in. add 11 for the final ⅛ in., making a total of 39 cu ft per hr.

To show you that this rule of thumb varies only slightly from the average value given by the equation, let's compute the total volumetric rate of cutting oxygen for a 1 in. thickness. By the rule of thumb we get a total of 94 cu ft. Substitution of 1 for T in the formula reduces the right-hand side of the equation to 95.5. The difference between 94 and 95 ½ cu ft is only 1½ cu ft of cutting oxygen—less than a 2% error. For rapid estimating purposes, the difference is practically negligible.

As a word of caution it should be remembered, however, that this portion of the rule of thumb holds only for metal thicknesses of from ⅛ to 2 in. Values for some of the more common thicknesses are given by the various blocks: ½ in., 50 cu ft; 1 in., 94 cu ft; 1½ in., 138 cu ft; 2 in., 182 cu ft.

For Thicker Metals

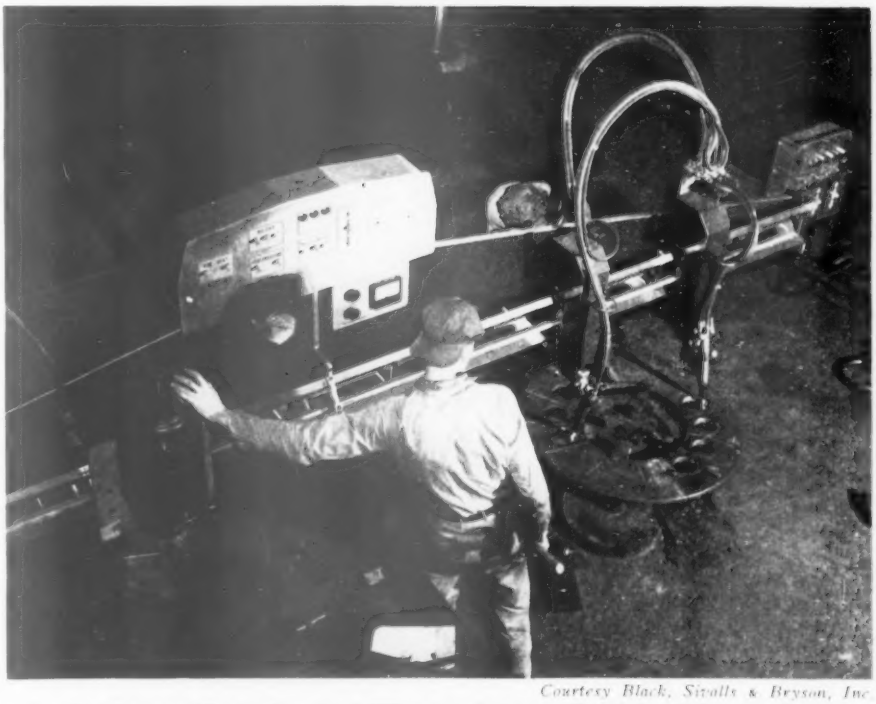
The portion of the rule of thumb which deals with cutting volumes for thicknesses above 2 in. is given in Fig. 18. For the sake of comparison, the curve and its equation shown in Fig. 17 is repeated here. To cut 2 in. thick material by the previous method requires a volume of 182 cu ft per hr. In Fig. 18, the figure becomes 180 for 2 in.; the difference is negligible and the round number is slightly easier to remember. Volumes are again indicated on the bottom of the block diagram for the metal thicknesses portrayed on the left.

This rule of thumb is good for thicknesses of from 2 to 15 in. In using it, a volumetric rate of 180 cu ft per hr for the first 2 in. of thickness is required. For every additional inch of metal thickness, the oxygen consumption per inch increases at the rate of 55 cu ft per hr. A 4 in. piece of stock, for instance, will require 180 cu ft per hr for the first 2 in., and 55 cu ft per hr for each inch of the final 2 in., making a total of 290 cu ft per hr.

The significant figures to remember are 180 cu ft per hr for the first 2 in., and 55 cu ft per hr for each additional 1 in. up to 15 in. of thickness.

Rules for Cutting Speed

Everyone who has done any flame-cutting realizes that as the plate thickness increases, the actual torch travel speed must decrease. There can be set up a mathematical relationship between thickness and average speed in inches per minute. This is



Courtesy Black, Sivalls & Bryson, Inc.

Fig. 21—The two cutting torches, set at different angles, are cutting circles of the same diameter. They produce beveled holes at different angles while traveling in opposite directions.

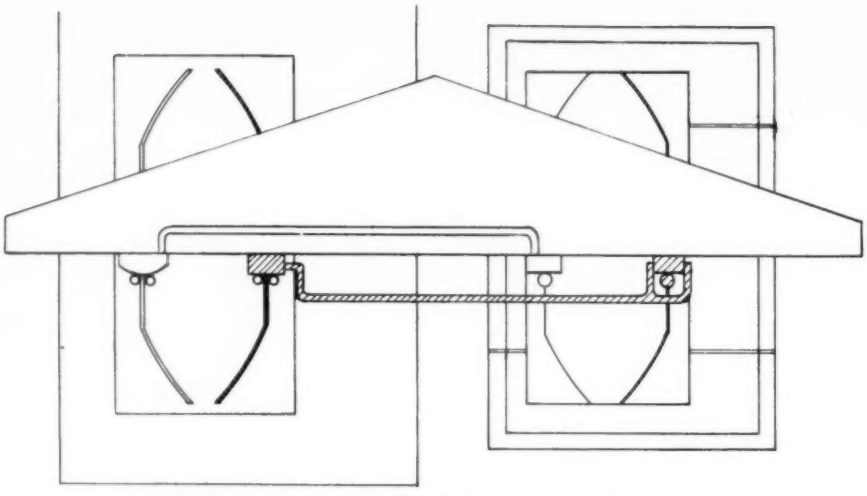


Fig. 22—Plan view of a shape-cutting set-up for making simultaneous cuts on the inside and outside of a crane boom side member.

given by the equation $S=11.5T^{-0.3869}$. This hyperbolic function is next to impossible to solve without the aid of tables or a log log slide rule, so it has again been broken down into two general rule-of-thumb relationships.

To the left of Fig. 19 is shown the relationship for plate thicknesses of from ¼ in. to 1¼ in. The first column lists nominal thicknesses for the five examples shown, while the second column converts these thicknesses into the proper number of eighths. The rule of thumb is applied thusly: ¼ in. plate is the equivalent of ⅜ in. Subtract the figure 2 from the number 20, a constant, and obtain 18. This remainder, 18, is the average speed in inches per minute of torch travel.

For a thickness of ⅜ in., the numerator 3 is subtracted from 20, giving a remainder of 17, which is the approximate cutting speed in inches per minute. For 1 in. of thickness, it is only necessary to subtract 8 (number of eighths in one inch) from the base figure 20 to obtain the remainder of 12, the approximate speed in inches per minute.

This rule of thumb is reasonably accurate from ¼ to 1¼ in. For thickness under ¼ in., it is obvious that the speed is greater than 20; it is generally in the neighborhood of 25 in. per minute.

Thicknesses from 3 to 12 In.

For plate thicknesses from 3 to 12 in., the rule of thumb is different. The first column on the right-hand side of the sketch (Fig. 19) indicates plate thickness, and the second column indicates speed in inches per minute. It will be seen that the two figures of 6 in. thickness and 6 in. per minute are bracketed. This is the starting point to remember. For every increase in thickness of 1 in., the speed should be decreased by approximately ½ in. This is fairly obvious from the table, as 7 in. thickness has a speed of 5½ in., 8 in. has 5 in., 9 in. has 4½ in., and so on up to a maximum of 12 in. thickness with a speed of 3 in. per minute.

It will be recalled that 1¼ in. metal can be flame-cut at approximately 10 in. per minute, and 3 in. metal at about 7½ in. per minute. These plate thicknesses represent the maximum and minimum speed values respectively that may be determined by the two rules of thumb. Speeds covering plate thicknesses from 1¼ in. to 3 in. can be estimated quickly by remembering that the speeds will be between 7½ to 10 inches per minute.

It is hoped that these rules will assist flame-cutting operators to initially estimate suitable cutting speeds for any plate thickness, and to obtain approximate values of the cutting oxygen consumption. These estimates will hold in the majority of cases. It is believed that the extent of variations will be slight, especially so when due consideration is given to the varying factors mentioned in the opening paragraph.

Effect of Draglines

Fig. 20 depicts the effect of draglines on the side of a cut edge of plate. In this example, ⅝ in. plate is being cut. The amount of drag for a plate of this thickness might be in the neighborhood of 1/16 in. The percentage of drag is calculated as shown in the lower left-hand corner of the sketch. It is simply the distance that any line lags or drags behind its position at the top of the plate divided by the thickness of the plate and multiplied by 100.

In straight-line stripping, not much attention need be paid to the amount of drag if the final corner may be flame-cut. In some operations, however, it might be economical to speed up the cutting process during all of the length of cut except the last inch or so, and then slow down the machine so that no uncut corner will remain.

Shape cutting necessitates almost a

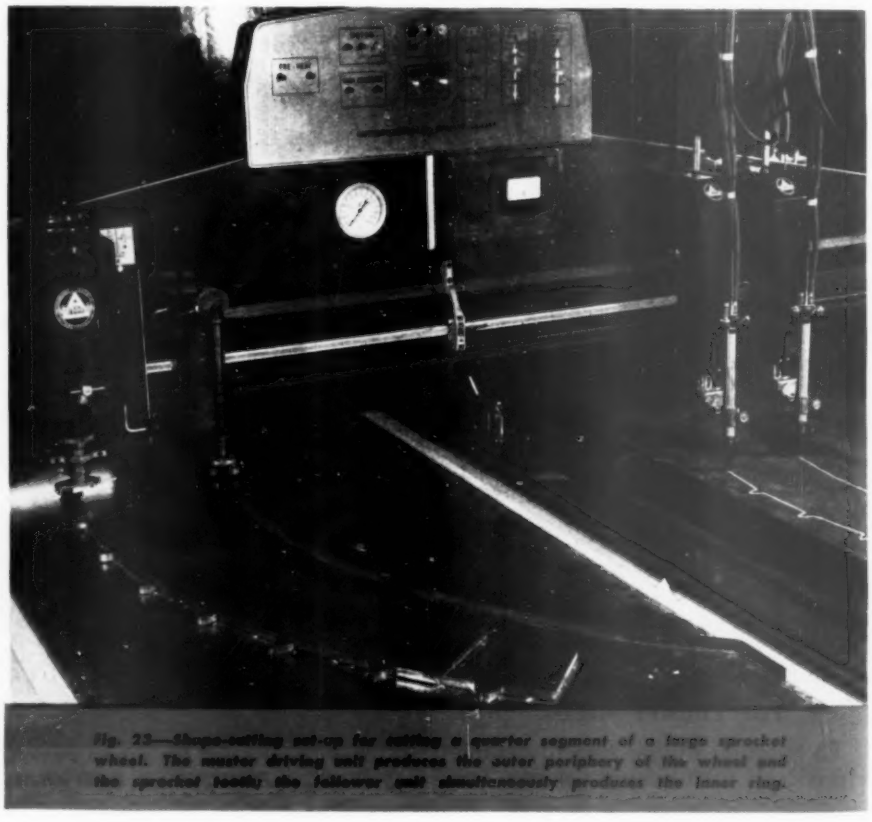


Fig. 23—Shape-cutting set-up for cutting a quarter segment of a large sprocket wheel. The master driving unit produces the outer periphery of the wheel and the sprocket tooth; the follower unit simultaneously produces the inner ring.

zero drag because, obviously, it might be possible for the upper portion of the cut to have made a complete change in direction before the lower part has reached that transition point. Zero drags are obtained at a slightly lesser torch travel speed.

Cutting Beveled Circles

The remaining illustrations will show different sizes of machines, some methods of operating them and various control devices. Fig. 21 is shown to illustrate some of the flexibility obtained with modern shape-cutting machines. Although the two cutting torches are set at different angles, they are cutting circles of the same diameter, as may be seen by inspecting the circle-cutting attachment under the driving head. Since the original angles of the torches are maintained during their rotations in a circular path, they produce beveled holes while traveling in opposite directions. The picture serves to illustrate one of the large variety of set-ups that are possible with modern shape-cutting machines.

Simultaneous Shape Cuts

Fig. 22 is a schematic representation of a simple attachment that solved a difficult production problem. The diagram represents a plan view of a shape-cutting machine with the template located to the left, on the work table. The template in this view is foreshortened; in actual size it was approximately 15 ft long by about 2 ft wide. The section obtained was used as a side member of a crane boom.

The interesting feature about this set-up is that both cuts were made simultaneously to eliminate the distortion produced by unequal distribution of the heat of the cutting operation. The problem of simultaneous cuts was solved by having the main driving unit (shown in outline) follow the left template strip and control the nearest cutting torch. This driving unit did the actual driving of the entire machine and was responsible for both longitudinal movement along the table and control of the sideways motion of the first cutting torch.

A follower driving unit (shown by the shaded areas) was positioned on the cross rails of the cutting machine, where it was free to move sideways. A connecting bar joined the idler follower unit to the second or outer torch. In this manner the driving unit and follower unit followed the path outlined for it and guided its respective torch. The set-up seems so obvious that one wonders why it was not thought of many years ago.

Fig. 23 is a photograph of a template that produced a quarter segment of a sprocket wheel 12 ft in diameter. As may be seen, the greater radius of the template is followed by the master driving unit, which produces not only the outer periphery of the wheel but the individual sprocket teeth as well. The path of the cutting torches is outlined in chalk on the actual plate that is positioned on the work table. The master driving unit directs the inner torch, while the follower template is connected to the farthest torch by means of the tie bar shown.

An interesting sidelight on this particular template is that at the beginning and end, the driving unit must propel the carriage backward a slight amount to follow the exact shape of the sprocket tooth. During this time the idler torch is also moved backward a slight amount, yet the indentation produced by the application of cutting oxygen to the section of metal for the second time is only slight, and the second torch picks up the cut without any hesitation during the progress of the cut on this inner portion of the ring. This particular plate thickness was of the order of 1½ in., and the allowable tolerance permitted was 0.008 in., a tolerance which was met by the shape-cutting department. This is an extreme degree of allowable tolerance, but it shows what progress flame-cutting has made in the last few years. Incidentally, the sections of the template that form the tooth shapes were made in a die so that each would be identical with the others and exactly what was desired.

Multiple Billet Cutting

Fig. 24 shows a machine designed and built for the multiple cutting of billets for shells. The billets were fed up to the machine from the back, and two of them were cut at a time. The successful operation of this machine depended also upon an adequate feeder system and a conveyor system that rapidly disposed of the cut billets to the nicking and forging operations. The picture shows one of the machines in operation. In normal usage several of these machines were placed side by side (there being additional machines to either side of the one shown), and each fed the cut billets on individual conveyor systems to one common conveyor that transported them to the nicking machine (Fig. 25) and on to the heating furnaces for eventual forging.

THE END.

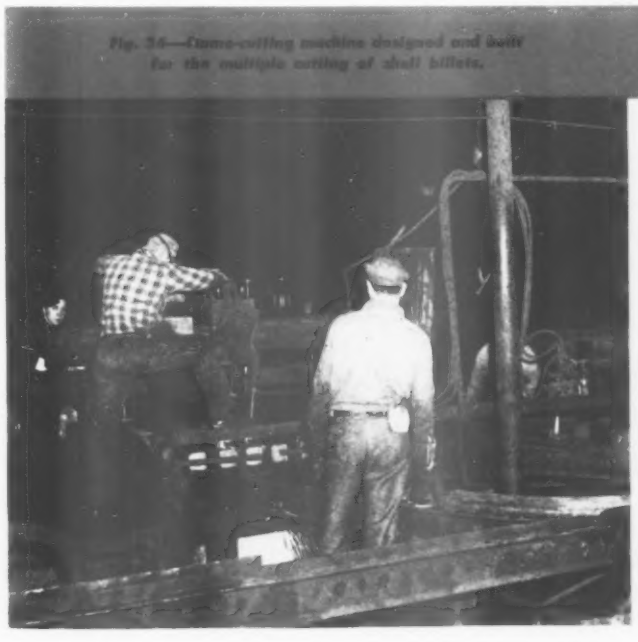


Fig. 24—Flame-cutting machine designed and built for the multiple cutting of shell billets.

Fig. 25—Nicking the billets prior to sending them to the breaking machine—a secondary operation in the production set-up shown in Fig. 24.

Economics of Arc Welding*

By WALTER J. BROOKING

Director of Testing & Research,
R. G. LeTourneau, Inc., Peoria, Ill.

★ Part One—Mr. Brooking discusses the eight chief factors which affect welding costs. These factors are universal in arc-welded fabrication, and the cost advantages of welding depend upon keeping them under proper control.

Fig. 1—This earthmoving scraper and high speed tractor owe their superiority largely to the difference between arc-welded design and other ways of producing machinery.

THE great extent to which the arc-welding method of producing machines and structures is used in modern manufacturing is an indication that it has certain inherent advantages both from an engineering and from an economic standpoint. The great growth in the amount of welded products during the past few years naturally has, to some degree, displaced older methods of manufacture.

Engineering Advantages

The advantages of welding have caused many units to be fabricated from rolled plate instead of cast iron, often saving from 20 to 40% in weight and obtaining in some instances special mechanical engineering advantages.

In other cases welding has displaced bolted or riveted construction; frequently an 8 to 15% saving in weight has been accomplished because welding joins edges whereas riveting or bolting fastens members of joints which have been lapped over one another and often reinforced with side plates. Not only is the attendant bulkiness of material considerably greater in bolted and riveted construction than in the joined edges of the welded construction, but greater rigidity and superior mechanical function are frequently found in arc-welded construction.

Arc welding of steel structural materials has made it possible to produce machines with operational efficiency which cannot be economically obtained by any other means of fabrication. The high speed tractor and earthmoving machine shown in Fig. 1 is an example.

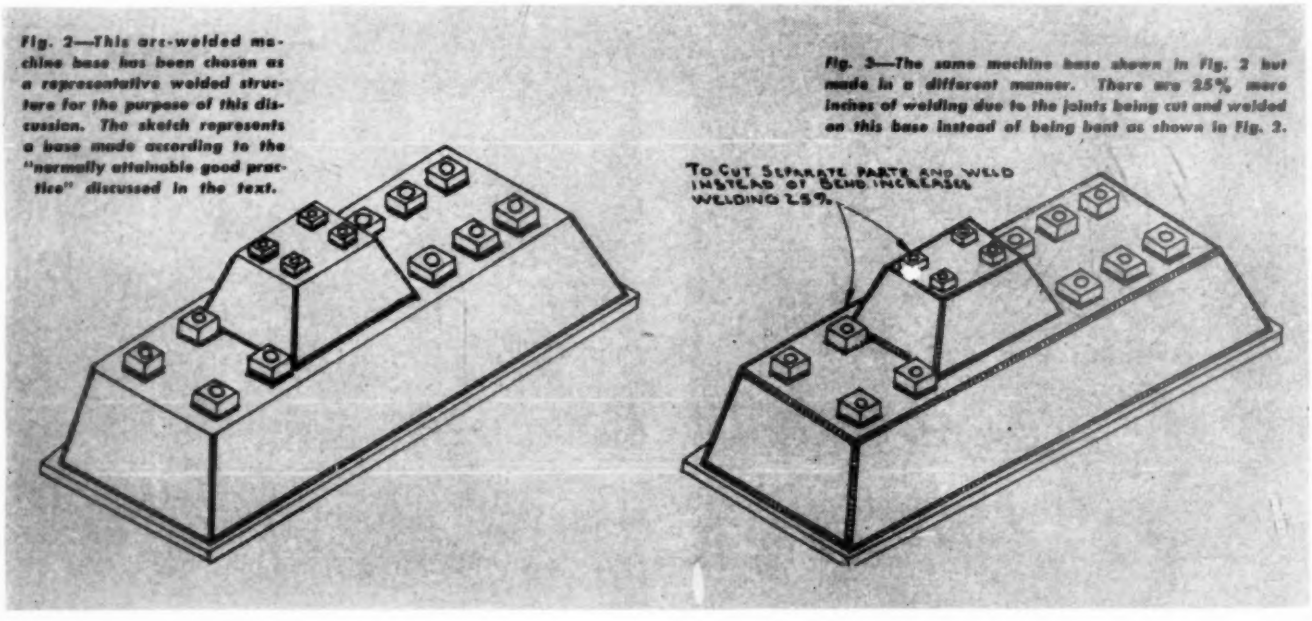
Eight Welding Factors

Much has been said and much reliable information is available upon the flexibility, the economy and the overall practical aspects of the use of arc welding in modern manufacture. It is the purpose of this discussion to present the relationships of several

*More complete coverage of the problems given may be found in a recent book by the author, *Arc Welding Engineering and Production Control*, published by McGraw-Hill Book Co.

Fig. 2—This arc-welded machine base has been chosen as a representative welded structure for the purpose of this discussion. The sketch represents a base made according to the "normally attainable good practice" discussed in the text.

Fig. 3—The same machine base shown in Fig. 2 but made in a different manner. There are 25% more inches of welding due to the joints being cut and welded on this base instead of being bent as shown in Fig. 2.



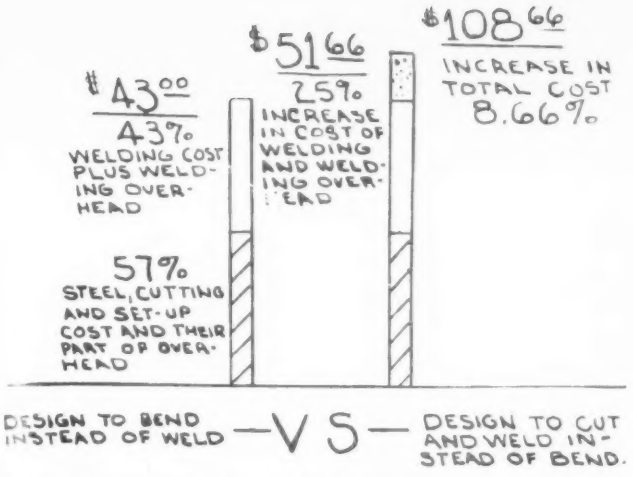


Fig. 4—Comparison of welding costs by the methods shown in Figs. 2 and 3.

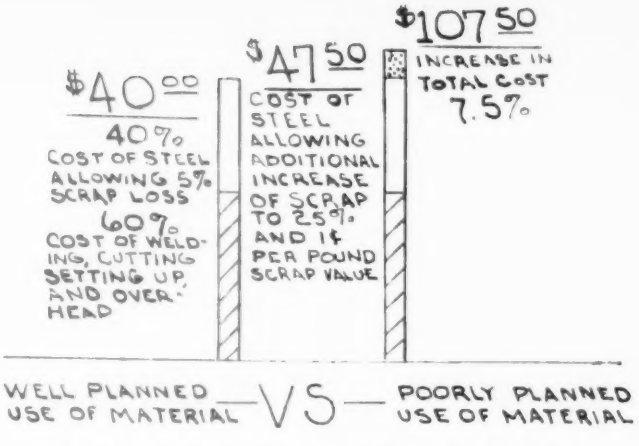

$40.00
40%
COST OF STEEL ALLOWING 5% SCRAP LOSS
60%
COST OF WELDING, CUTTING SETTING UP, AND OVERHEAD
$47.50
COST OF STEEL ALLOWING ADDITIONAL INCREASE OF SCRAP TO 25% AND 1¢ PER POUND SCRAP VALUE
$107.50
INCREASE IN TOTAL COST
7.5%
WELL PLANNED USE OF MATERIAL
—VS—
POORLY PLANNED USE OF MATERIAL

Fig. 6—How the increase in scrap costs affects the total cost.

important factors common to all welding applications which greatly affect the total cost of the welded structure. Specifically, only eight of the many factors affecting the economics of welded construction will be dealt with here; these eight are considered especially important and all of them are so general that they are universal problems in welded construction. They are:

1. Designing to reduce the amount of weld metal required in the structures.
2. Planning the use of material to reduce scrap.
3. Use of setting-up fixtures to eliminate measuring and to standardize structures.
4. Use of positioning fixtures to deposit welds in the most favorable positions.
5. Use of the most economical size of electrode.
6. Obtaining a good fit-up of welded joints.
7. Controlling the sizes of welded joints.
8. Obtaining a good operator factor (use of the workman's time).

Example: A Machine Base

In order to provide a specific basis for demonstrating the importance of each of the foregoing factors, a hypothetical welded structure, the simple welded machine base shown in Fig. 2, has been selected. It is assumed that this machine base is made of arc-welded steel in any ordinary welding shop, and that it would be made on a mass-production basis like many repetitive manufacturing processes in present day welding production. This would assume at least one hundred units to be made.

To establish a fundamental basis of comparison, a production cost has been established assuming normally obtainable good welding practice in the manufacture. The bases are assumed to cost $100 each, based upon the following conditions, assumptions and values:

The finished weight of the base is 1,000 lb, consisting of 950 lb of steel and 50 lb of weld metal.

Cost Data

1,000 lb of steel (including a 5% scrap loss) at 4¢ per lb	$40.00
1.64 hr of setting-up time at $1.10 per hr. plus 150% overhead ($2.75 an hr)	4.50
5 hrs of cutting, shaping, machining and forming time at $1 per average plus 150% overhead ($2.50 per hr)	12.50
50 lb of deposited weld metal at 86¢ per lb	43.00
Total cost with normally obtainable good practice	$100.00

The cost of deposited weld metal assumed 70% continuous work including arc time and electrode-changing time, $1.10 per hr for labor for welding, 66⅔% electrode deposition efficiency, an electrode cost of 6¢ per lb, the calculation of overhead at 150% of the labor and the use of electrodes averaging ¼ in. in diameter. In the interests of clarity and simplicity, several small and relatively minor factors have been disregarded and some cost factors have been combined.

Electrode Costs Combined

An example is the inclusion of the cost of welding electrodes into the cost of deposited weld metal and using the latter cost per pound as a basis for calculating welding costs. This is justifiable because electrode costs are a small percentage of the total cost of the entire structure and, for most of the factors which are fundamentally associated with the deposition of weld metal, any increase in welding will result in an increase in electrode consumption and material cost. However, this method of expressing electrode welding cost does give a slight expansion of total cost because the 150% overhead is as-

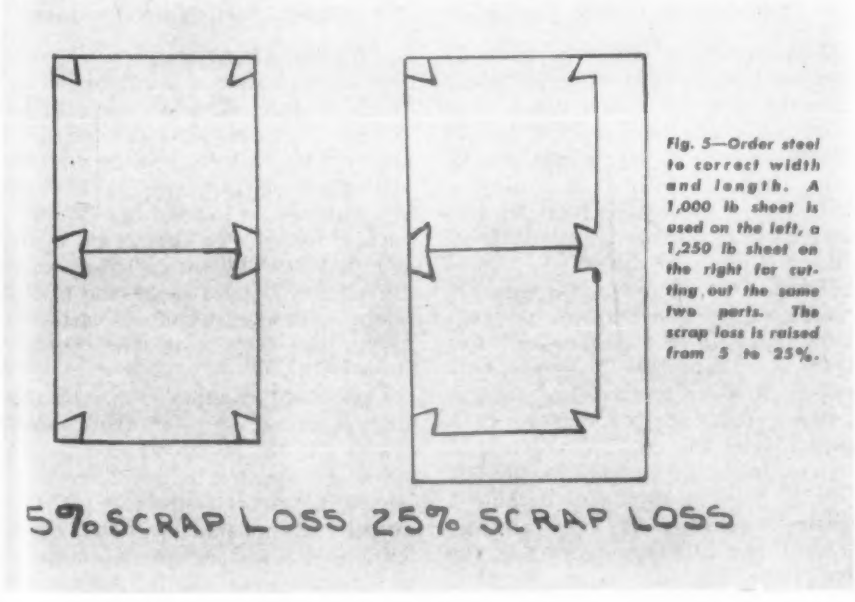


Fig. 5—Order steel to correct width and length. A 1,000 lb sheet is used on the left, a 1,250 lb sheet on the right for cutting out the same two parts. The scrap loss is raised from 5 to 25%.

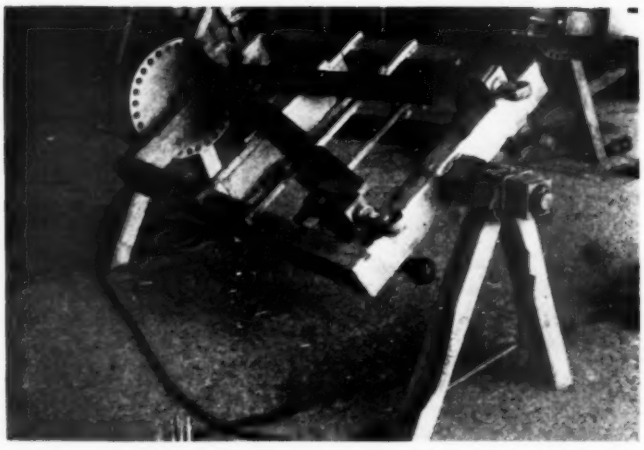


Fig. 7—A combination setting-up and positioning (spinner-type) fixture. The stops, clamps, pins and machined surface guards reduce measuring and set-up time to a small fraction of what it would otherwise be.

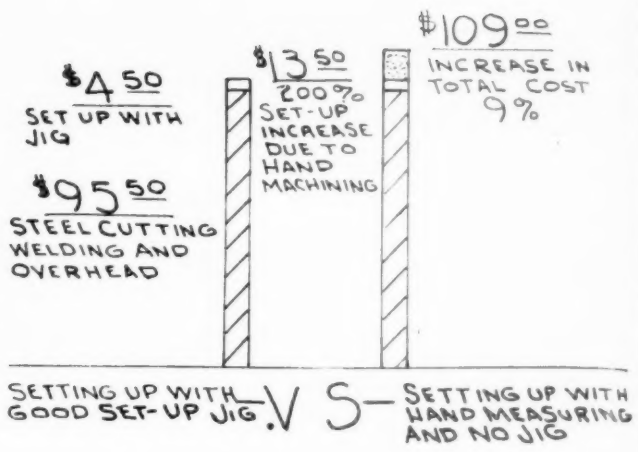

$4 50
SET UP WITH JIG
$95 50
STEEL CUTTING WELDING AND OVERHEAD
$13 50
200% SET-UP INCREASE DUE TO HAND MACHINING
$109 00
INCREASE IN TOTAL COST 9%
SETTING UP WITH GOOD SET-UP JIG
SETTING UP WITH HAND MEASURING AND NO JIG

Fig. 8—A 200% increase in set-up time amounts to $9 or a 9% increase in the total cost.

signed against the electrode cost as well as the welding labor. The added cost is relatively small in the machine base example selected for this discussion and may be conveniently neglected.

The basis for calculation is given in the discussion which follows. In all cases where a theoretical approach has been made the basis for the calculation, a stop-watch analysis of shop operation has been found to compare very favorably with the conclusions drawn from theory.

1. Design to Reduce Welding

Fundamentally, weld metal is expensive, and, all other factors being equal, the welded design with the least weld metal is the best. As soon as an organization has committed itself to produce a certain type of structure or equipment by arc welding, a careful analysis of the design of the unit to reduce the amount of necessary welding often yields important economic advantages.

In the case of the postulated machine base, Fig. 2, the side plates and top plate of the main base as well as the side plates and top plate of the smaller secondary boxlike base are made by notching the corners of two appropriately cut plates and bending the sides down so that the only welding required is at the corners.

A different method of making the same structure, shown in Fig. 3, requires more cutting and increases the welding 25%. Here the side plates and top plates are cut from separate plates by shearing or flame-cutting and are then set together and welded. This makes welded joints on the top corners of both the main base box and the smaller upper box instead of bent corners.

Relative costs of the two methods are compared in the graph, Fig. 4. With the bending and welding method shown in Fig. 2, the total cost of producing the unit is $100, of which welding cost including labor, materials and overhead amounts to $43 or 43%.

In the design shown in Fig. 3, using several pieces and welding them together instead of bending, the welding was increased 25%, representing a total increase in the cost of the finished unit of 8.66%. The number of parts in the individual structures was also increased from 17 to 25 and the finished weight from 1,000 to 1,012.5 lb.

Not included in the enlarged cost is the increase in handling and the increase in set-up time; it is assumed that this increase is offset by the higher overhead cost resulting from the bending equipment and fixtures used for a mass-production quantity of such units.

The largest saving results from the reduction of the weld metal, 8.66% of the total cost being a significant margin compared to the normal net profit of manufacturing organizations.

2. Planning to Utilize Material

Fundamentally, steel is a relatively inexpensive material. Nevertheless, planning for economical use is well worthwhile. In many cases of welded construction, parts taken from sheets, bars, strips or plates can cause the scrapping of moderately high percentages of the purchased material because of their odd shapes.

To illustrate the point, the normally good practice assumed for the machine base in this discussion uses 1,000 lb of raw steel, of which only 5% or 50 lb is scrap. How careful planning reduces the scrap loss is illustrated by the cutting diagram of the two main parts shown on the left of Fig. 5. The right side of Fig. 5 illustrates a somewhat less carefully planned use of material wherein the two parts are cut from standard 1,250 lb sheets instead of 1,000 lb sheets. On this basis, an additional 250 lb of steel must be charged to each machine base. At 4¢ per lb this costs $10. Allowing 1¢ per lb scrap value, there still is a net increase of $7.50 to be added to the cost of the unit, representing a 7½¢ increase in the total cost.

Square or regularly shaped oblong parts such as shown in Fig. 2 should normally be produced with a relatively small percentage of scrap. In the case of circular or irregularly shaped parts, 25, 30 and even up to 50% scrap is not unusual nor even uneconomical in many cases. It is a source of additional cost, however, some of which may be eliminated by careful planning.

Fig. 6 depicts graphically the effect of the increase of the steel scrap to 25% of the raw material and demonstrates the resulting cost increase of 7.5% to be a significant figure. It would provide a margin of $750 on 100 of these machine bases.

3. Quick Setting-up Features

Any sound method of mass production must produce a standardized finished product. One of the most important contributions to standardized arc-welded products is a fixture for setting up the component parts of the structures prior to welding. Without such a fixture, the setting-up operation may be done with a widely varying amount of measuring and loss of operator time resulting in variations in the setting-up costs from product to product.

Good welding practice dictates that for a repetitive operation there should always be setting-up fixtures which allow the operator to place the component parts of a structure in their proper relationship without error. This should be done with a minimum of measuring and careful positioning

Fig. 9—Jigs which position welds for most economical deposition pay dividends on mass-production jobs. This is an all-welded, power-driven, universal-type positioner.

Fig. 7 shows a fixture which provides: stops; a framework upon which to place the parts; plugs, guards and clamps to accommodate premachined parts and all other parts in their proper relationship. This fixture reduces setting-up time to a bare minimum and provides maximum standardization of the structures.

Stop-watch studies of setting-up operations with and without fixtures indicate differences of several hundred per cent. This is mostly due to the additional measuring and fastening time required without a fixture. Assuming a very conservative 200% difference and assuming that set-up time with a fixture amounts to $4.50, the total set-up cost without a fixture is $13.50—a 9% increase in the overall cost (Fig. 8). This represents $900 on 100 machine bases—a good margin with which to build a simple set-up jig and still realize a profit.

4. Use of Positioning Fixtures

Because weld metal is a liquid at the time it is deposited, the position of the joint automatically establishes certain limitations on the size of the electrode and the amount of molten metal which can be deposited within a given time. Ordinarily, the nearer the joint may be placed to a completely downhand or troughlike position, the less the difficulty encountered due to the fluidity of the metal and, within certain limits, the larger the welding electrode which may be used. This is especially true of heavier plates, but it also applies to even the relatively light plates used in the machine base being discussed.

There are many types of jigs or positioning fixtures to place joints in the best position for welding. Fig. 9 shows a power-driven mechanical positioning fixture that is similar to standardized commercial types. The use of such a positioner would be applicable to the machine base selected for this discussion and would provide a good advantage. The positioner would also be usable for other welding jobs in a welding production shop.

Fig. 10 illustrates in graphic form the relative cost of depositing ⅜ in. welds in three different positions—vertical, horizontal fillet and downhand fillet. The figures in this graph are based on numerous time studies of actual weld-deposition time under normal shop conditions, including arc and electrode-changing time. An appropriate allowance for operator fatigue (20% of the total time) is also added.

The normally good operating conditions under which the machine base was to be welded assumed downhand positioned welding using a positioning fixture. If this unit were not positioned in a fixture, additional handling time to position it by blocking it up or the additional time required to deposit the horizontal welds in the horizontal fillet position and the corner welds in the vertical position would increase the cost considerably.

Conservatively interpreting the values shown in Fig. 10, the unpositioned welding of this unit would increase the cost of welding by 50% (since the normally good practice figure represents a 33⅓% reduction of the unpositioned practice). In this particular case, the result of not positioning the welds would represent an increase in welding cost of $21.50 or 21½% increase in the total cost of the structure. This, obviously, represents a very considerable margin for operation.

Under ordinary conditions, if not ideal practice, a larger amount of weld metal would usually be deposited in the vertical or horizontal fillet positions because of the tendency for the lower leg of a weld deposited in the horizontal fillet position to be longer than the upper leg. This produces a degree of overwelding if the upper leg is made the specified size.

The increase of 21½% in the total cost, diagrammatically shown in Fig. 11, is based on actual time studies and numerous examples throughout the welding industry as a whole; it is a margin which is not overstated in this case but rather conservatively stated.

NEXT MONTH: Mr. Brooking will discuss the remaining four factors in arc-welding economics: electrode size, fit-up of joints, control over the size of joints and operator factor or use of the worker's time.

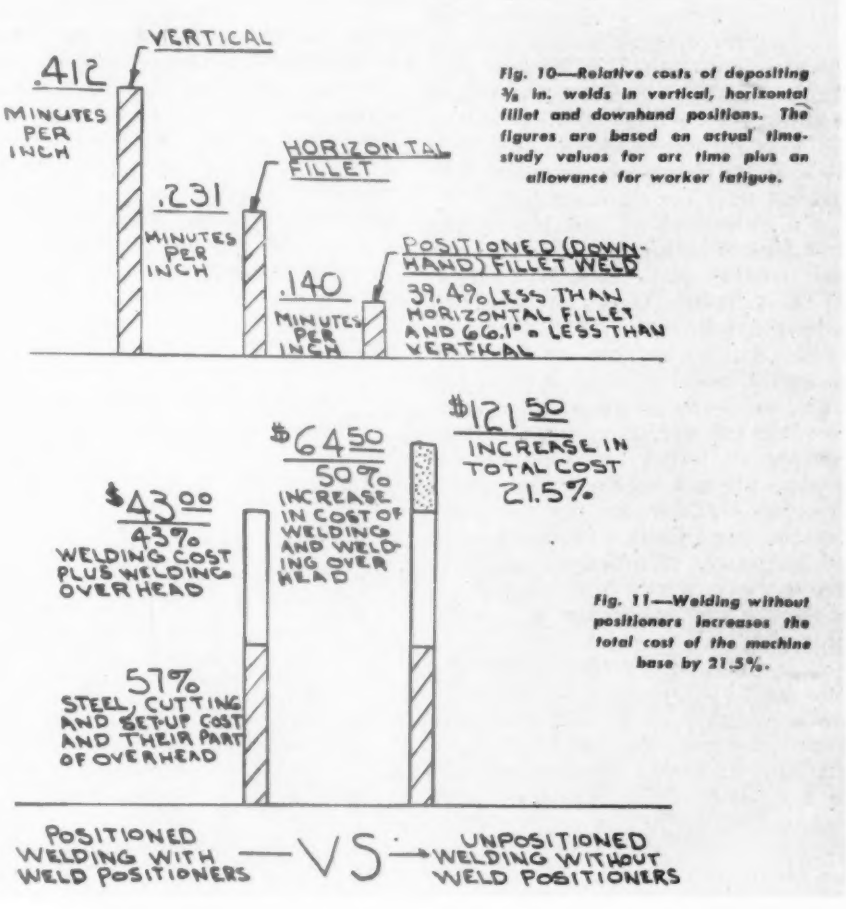


Fig. 10—Relative costs of depositing ⅜ in. welds in vertical, horizontal fillet and downhand positions. The figures are based on actual time-study values for arc time plus an allowance for worker fatigue.

Fig. 11—Welding without positioners increases the total cost of the machine base by 21.5%.

WELDER'S NAME

BADGE NO. SHIFT

CREW NO.

SIGNED BY LEADMAN

Rod Used Size	Amt.	Compartment Used In.	Remarks
1/8"			
5/32"			
3/16"			
7/32"			
1/4"			
5/16"			
1/8"			
5/32"			
3/16"			
7/32"			
1/4"			
5/16"			
1/8"			
5/32"			
3/16"			
7/32"			
1/4"			
5/16"			

Fig. 5—Proposed card for the individual weldor to use in recording his daily electrode consumption. Spaces are provided for six different electrode sizes in each of three compartments.

Ideas That Meant Dollars

(Continued from page 41)

detail. Mr. Zeigler was one of the 33 employees receiving honorable mention, and his contribution deals with a method of keeping accurate records showing the welding footage made by each weldor. Weldors' records may be compared against a standard, against the records of their fellow workers on like work, or crew may be compared against crew and shift against shift, per man average.

"The method of arriving at the standard to be used must be accurate and based on facts," said Mr. Zeigler. "The necessary facts can be determined as follows:

"1. Under average welding conditions of position, fit-up, type of rod used, weld-size specifications, spatter loss, run-off and stub, only a certain number of inches per weld can be made with each electrode consumed. It is logical, therefore, that the number and size of electrodes used must be accurately recorded in order to determine correctly the amount of footage a weldor can lay in a given time.

"2. From an electrode consumption record per man per day (Fig. 5) and a "fact table" (Table I) which shows the average length of weld that can be obtained from an electrode of a given size, the footage of weld laid down by a weldor can be determined simply by multiplying the number of electrodes consumed during a day by the figure given in the fourth column of the table. This gives the weldor's footage per day. Divide this by the hours worked, to obtain the footage per hour for the man.

"3. To set the standards of welding footage expected on a particular compartment, a takeoff is made from blueprints showing the specifications on the sizes and lengths of welds and the positions of welding needed. From this data, an average-size weld, electrode and position can be determined for the given compartment.

"4. The amount of footage required for the given compartment is divided by the amount of footage that can be obtained from an electrode of the average size that will be used to weld the compartment. This gives the number of average-size electrodes required to complete the compartment. When the record of electrode consumption for the compartment is turned in, it will be easy to determine whether or not the welding has been up to par by simply comparing the electrodes actually used with the predetermined standard.

Too Much and Too Little Rod

"Use of too much rod can mean: (1) welds were made oversize; (2) poor fit-up by the shipfitters; (3) bad operation because of too much loss by run-off, spatter or large stubs. Remarks can be written by leadmen on the individual electrode consumption reports to tell which of these conditions prevails.

"Use of too little rod can mean: (1) underwelding; (2) welds missed; (3) too large spaces between skip or chain welds. Inspection reports will show which of these is the true cause. Too little rod used can also mean good operation with less waste of rod by run-off, spatter and stubs than the average. This also will be determined by inspection. Variations from standard can be investigated, and means found to correct the faults thus disclosed.

"5. From the number of electrodes required per compartment or per ship, the number of electrodes of a certain size in a pound, electrode cost per pound and the number of man-hours required, an accurate cost for welding the compartment or the ship can be predetermined. The calculated figure can then be compared against the actual cost of the completed job.

"The average values needed to compute the electrode costs can be obtained from Table I, while Table II shows the allowable rates for welding with various sizes of electrodes."

Table I. "Fact Table" for Calculating Electrode Consumption

Weld Size, In.	Electrode Diam, In.	Electrode Length, In.	Average Length of Weld, In., Any Position	Average Number of Electrodes Per Lb	Average In. of Weld Per Lb. of Electrodes
1/8	1/8	14	15½	17.7	268
3/16	5/32	14	10	11.6	116
1/4	3/16	14	9½	7.6	72
5/16	1/4	14	12	3.7	44
3/8	1/4	18	9	3.1	27

Table II. Allowable Rates for Welding
(25% Fatigue Time Allowed)

Weld Size, In.	Electrode Diam, In.	Electrode Length, In.	Feet and Inches Welded Per Hr	Welded in 8 Hr
1/8	1/8	14	34′ 9″	278′
3/16	5/32	14	23′ 10″	191′
1/4	3/16	14	22′ 6″	180′
5/16	1/4	14	14′ 7″	117′
3/8	1/4	18	7′ 11″	63′

Seven Simple Rules

The formulas necessary for calculations are:

(a) Multiply the electrodes used by the average inches of weld per electrode to obtain the number of inches welded.

(b) Divide the electrodes used by the average number of electrodes per lb to obtain the total pounds of electrode used.

(c) Multiply the cost per pound of electrodes by the total pounds used to obtain the total electrode cost.

(d) Multiply the man-hours used by the average operator-cost per hour to determine the total operator cost.

(e) Add the electrode cost to the operator cost to determine the total welding cost (minus cost of the electricity used).

(f) Divide the total welding cost by the number of inches welded to determine the cost per inch of weld.

(g) Multiply the cost per inch of weld by 12 to obtain the cost per foot of weld.

"A specific example will best show the method of using the tables and formulas. A compartment requires 6,000 in. of $^3/_{16}$ in. welds. From Table I, the average size of electrode that will be used is $^5/_{32}$ by 14 in., and the average length of weld per electrode is 10 in. Dividing 6,000 by 10, 600 electrodes will be required. Table I also shows that the average number of inches per lb of $^5/_{32}$ in. electrodes is 116 in. Dividing 6,000 by 116 gives 51.72, the number of pounds required.

"Table II shows the allowable rate for making $^3/_{16}$ in. welds to be 23 ft 10 in. (286 in.) per hour. Dividing 6,000 by 286 gives a time of 21 hours required to weld the compartment.

"The electrode cost is obtained by multiplying 51.72 lb by the cost per lb, in this case 10¢. This gives a cost of $5.17 for electrodes.

"The operator cost is obtained by multiplying 21 hours by the average wage of $1.20 per hour, giving a labor cost of $25.20 for welding the compartment. Thirty per cent of this or $7.56 is added for overhead.

"The approximate total cost for welding the compartment, obtained by adding $5.17, $25.20 and $7.56, is found to be $37.93.

Suggestions for Electrode Reports

"Each weldor should make out his own report (Fig. 5) at the end of his shift and give it to his leadman, who in turn checks, signs and clips it with other cards from his crew. The leadman deposits all of his cards in a box (to be provided near his check station) as he goes off shift.

"The department that makes up the reports on welding (progress department) will pick up the cards from the boxes daily. There is room on each card to show work by one weldor in three compartments, using six different sizes of electrodes per compartment. A weldor who works in more than three compartments must use two cards. The cards should be made up in pads of 30 sheets that each weldor can carry with him. Under the column labeled "Remarks," he can state the condition of the job as he found it in that compartment —bad fit-up, tacking for fitters, number of rods wasted because of bending them to get at tough places, etc. If more space is needed for remarks, the back of the card can be used.

"Any pertinent facts on the general progress and standing of a weldor should be shown with his record; for example, such data as tacking 75% of the time, repairing bad jobs, etc.

What Will Be Accomplished

"I believe that this suggestion will: "Improve quality by showing up bad workmanship through the use of too little or too much rod.

"Reduce material cost. Knowing that the management knows how much rod is required to do a given job will cause the weldor to take care of his rod.

"Reduce labor cost by setting a fair standard of output for the weldors.

"Eliminate scrap by cutting down on rework. Since rework lowers a weldor's average of footage, he will endeavor to make more jobs correct the first time and so save on his rod loss.

"Increase safety by minimizing the careless handling of discarded electrodes and stubs. Each electrode goes against the weldor's record, and he will check on them.

"Reduce overhead by increasing the footage output per man of each leadman, foreman and supervisor. There will also be less rod to be picked up and sorted for reuse by weldor helpers."

Sell Farmers at the Fair

James Alcock, general manager of the Saginaw Welding Supply Co., Saginaw, Mich., has found that an effective way to sell welding equipment to the farmer is to catch him at the county fair. During the past two years the company has exhibited at the Saginaw County Fair, and it has sold welding equipment the year around as the result of visits to its tent by farmers and others from the rural area of northern Michigan.

At this year's fair (see picture below) the company featured arc and gas welding equipment, power tools and steel shop equipment. Each item was marked plainly with the price so that the interested prospect would be able to know how much an article would cost before he started to ask questions about it. The results of this self-selling method, added to an active program of equipment demonstrations, were that Alcock and his co-workers had nothing to take home on Saturday night when the fair closed. They sold everything that had been on display and in addition took many orders for subsequent deliveries to other farm customers.

Welding supply jobbers throughout the country, especially those serving rural areas, might take a note from the book of the Saginaw Welding Supply Co. and increase their sales to farmers.

Farmers were greatly interested, as this picture proves, in the exhibit of the Saginaw Welding Supply Co. at the county fair.

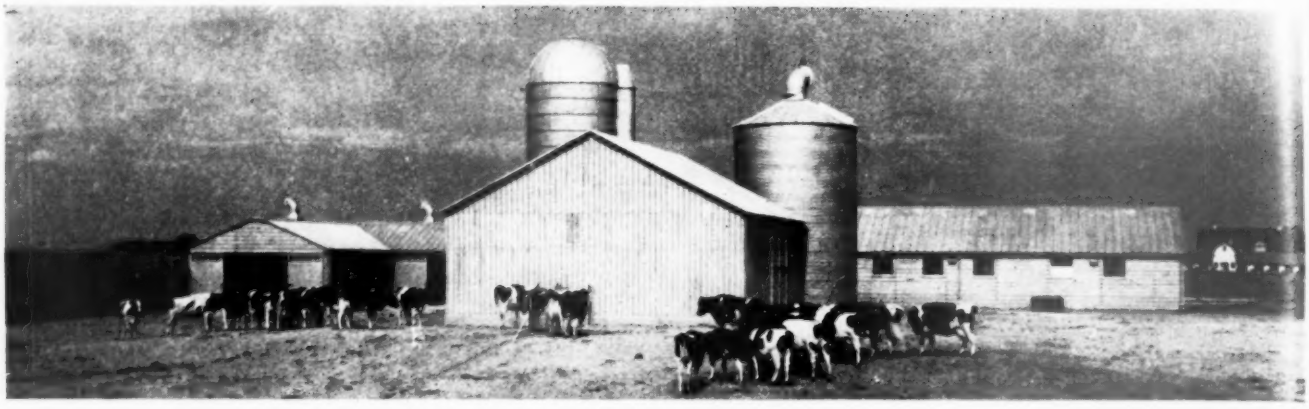


Fig. 1—Steel farm buildings are durable, fireproof and add much to the prosperous look of a well kept farm.

Welded Farm Buildings

Plans which will be made available without cost to job operators provide for barns, machine sheds, shops and other agricultural buildings which can be fabricated on the site by welding standard structural steel members.

By **T. B. JEFFERSON**

WELDING kept much of our farm machinery on its wheels during the war, and now that war is over it is going to find a new role in keeping farm equipment out of the weather. The scope of the welding shop in an agricultural area will be widened by the application of welding to such farm buildings as barns, machine sheds, shops and other functional agricultural buildings. Building frames which can be welded on the site will mean more jobs for the portable welder. Plans for such buildings, properly engineered, will soon be available to the job welding shop operator.

Improved Farm Layout

It is generally conceded that there is considerable room for improvement in the design and utility of farm structures. The present tendency is to mechanize the handling of feed and other items on a much greater scale than in the past, but to do this it is necessary to improve the layout of farm buildings. The ultimate objective of mechanization is, of course, that of labor saving, and this is accomplished as much by reducing the number of steps as by reducing the energy required to accomplish the routine chores of the farm.

To assist in the accomplishment of these aims, the Carnegie-Illinois Steel Corp. is developing plans which will be made available without cost to job shop operators. Surprisingly, these farm buildings are not of all-steel construction. Instead they combine various types of materials so that the best combination for economical construction will be employed. For example, if a clear span is desired on a building over 24 ft wide the best combination to use is a steel frame and wood studs. Buildings of lesser span will probably be of timber frame construction or possibly be prefabricated.

A steel building may be assembeld with either bolted or welded trusses, but the latter is more economical. Just to test this out a pilot barn was built on the East Hill Dairy Farm of the University of Wisconsin, and it was found that a site-welded steel truss was considerably less expensive to assemble from a labor standpoint than a bolted truss. The welded truss also required about 10 to 15% less material.

Barns from the Welding Shop

The plans for site-welded buildings will make it possible for the job shop operator to provide his customers with welded steel frame buildings of varying clear-span lengths in any length of 2 foot multiples. These span sizes will cover a large number of building requirements. The details are quite simple and readily understood, and the resultant structure may be a straight-line structure or L or T shaped with one or more wings. Practically any desired shape may be obtained by combining the three basic frame sections: the end section, center bay section and wing intersecting section.

Many one-story farm buildings having clear spans of from 24 to 40

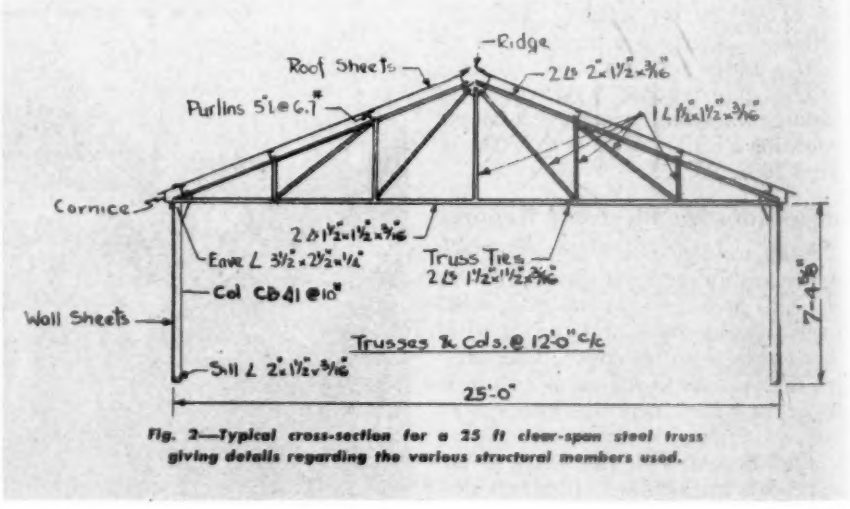


Fig. 2—Typical cross-section for a 25 ft clear-span steel truss giving details regarding the various structural members used.

it will need no more than nine and possibly as few as five sizes of steel members for the framework, primarily standard angles, channels, light columns and plates. A combination of steel with other building materials may require an even smaller number of steel sections.

The small number of steel members required to be stocked makes it practicable for every progressive building material dealer and job welding shop to serve the rural trade by carrying standard sizes of steel products. The local builder can then order from the local dealer steel that can be quickly fabricated at the site to meet specific needs. Shipping, handling and warehousing of cumbersome and numerous parts are thus eliminated. A great many different sizes and kinds of buildings can be constructed from a small number of steel parts, which are cut to the desired length and permanently welded right on the site into a strong structure.

Standard Mill Sections Used

Only seven different shapes and two plate sizes were used on the 25 ft wide by 60 by 48 L-shaped feeding barn built at the University of Wisconsin farm. The standard mill sections used in this construction were as follows: angle roof trusses and struts, 1½ by 1½ by $\frac{3}{16}$ in.; angle roof trusses and window sills, 2 by 1½ by $\frac{3}{16}$ in.; columns, 4 in., 10 lb H-beams; purlins, 5 in., 6.7 lb channels and $\frac{3}{16}$ in. plate. Fig. 2 gives the details regarding the locations of these various sections.

Experience has shown that the 5 in. channels used for purlins should be replaced with 4 in., 5.4 lb channels. This will eliminate one size of material since 4 in. channels are also used for studs. When the relaxation of wartime restrictions again permits the rolling of 4 in., 7½ lb H-beams, the lighter section may be satisfactorily used for the columns. Lighter channels such as 3 in., 5 lb would also prove satisfactory for roof purlins on an 8 ft bay span. If the size of the building is increased to a 40 ft span, 2½ by 1½ by $\frac{3}{16}$ in. angles should be used in the roof trusses.

Some may argue that a steel-frame, site-welded building will be too expensive. Actual experience does not indicate this, especially in the middle west. In sections of the country where local timber is available for framing, it would, of course, be difficult for steel construction to meet the prices of competitive materials. Likewise, the cost of labor in various sections will also influence overall costs to varying degrees. In general, however, steel will compete favorably

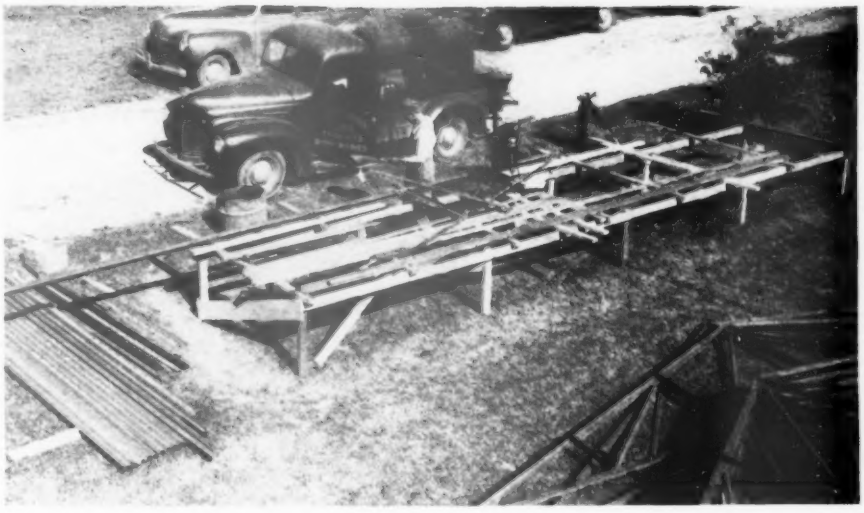


Fig. 3—Very little equipment is required for a site-fabricated steel frame structure. A simply built work table, portable welding and flame-cutting equipment plus a few hand tools are all that are needed to do the job.

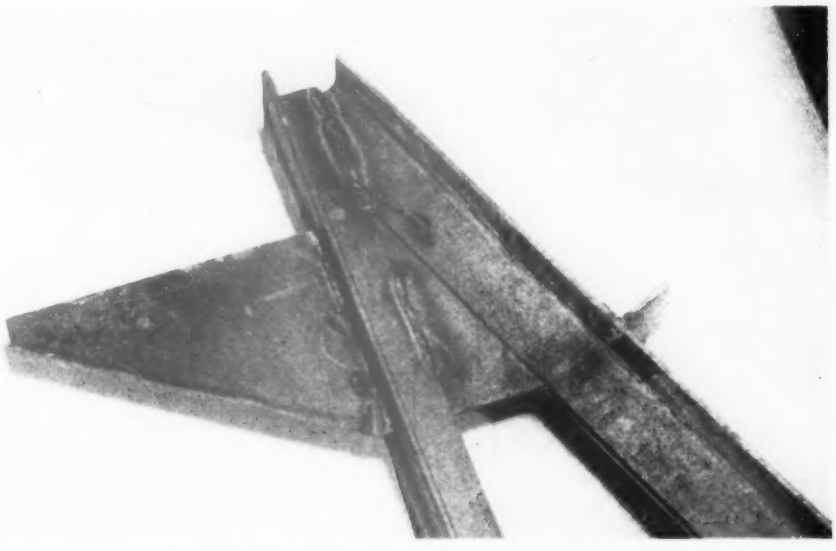


Fig. 4—Details of the welded joint at the eave end of the truss. The only flame-cutting of angles (other than to length) is the trimming of the leg of the top chord angle as shown.

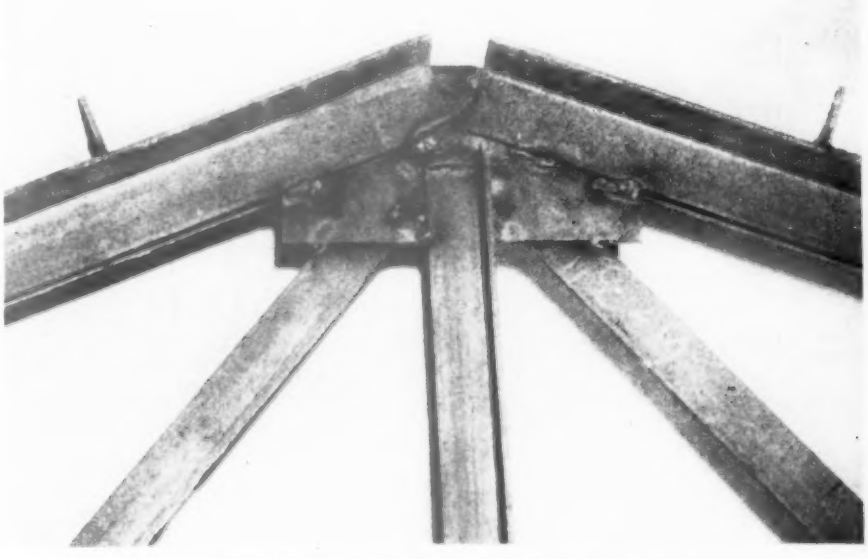


Fig. 5—Details of the ridge gusset plate showing the manner in which the chord angle struts and braces are attached.

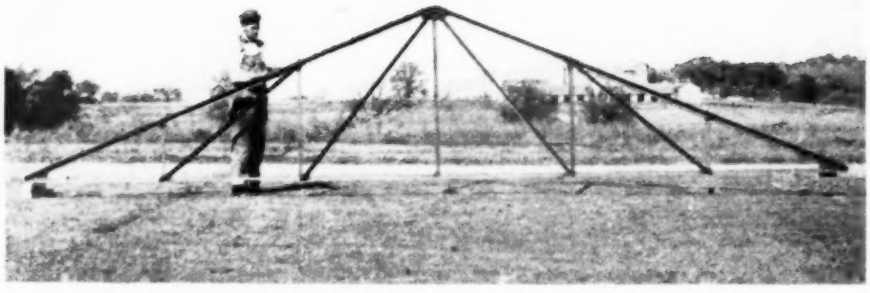


Fig. 6—The completed 25 ft span truss. This truss can readily be fabricated in two hours and it weighs only 293 lb.

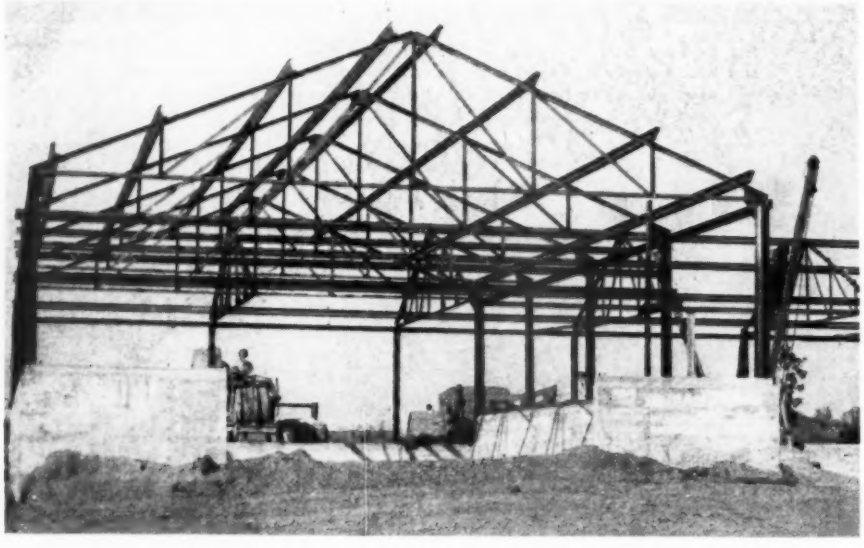


Fig. 7—This is the framework of a site-welded steel structure. Bolts were used only to anchor the columns and studs to the foundation; all other connections were welded.

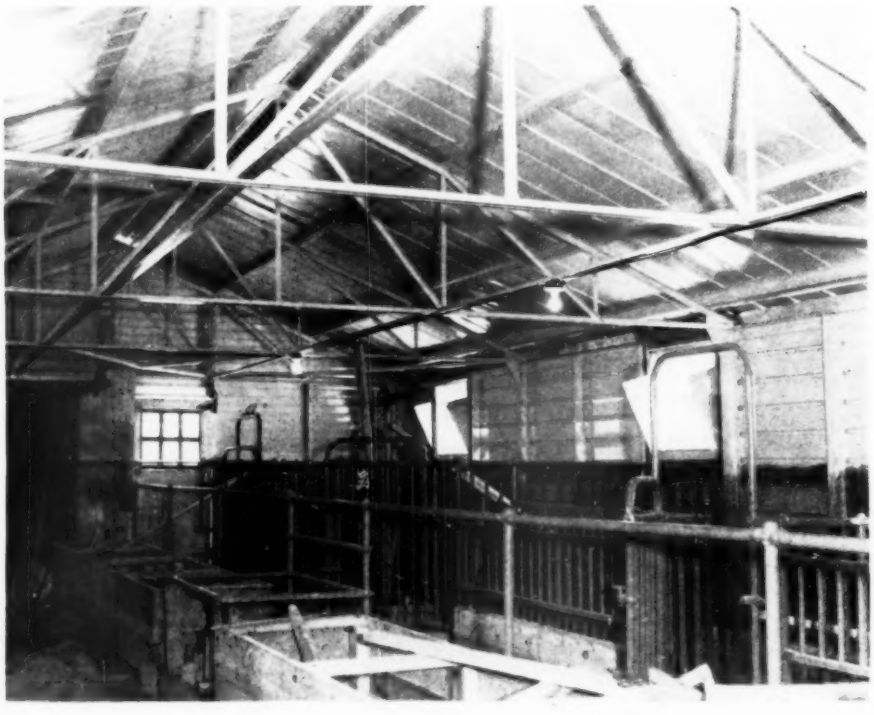


Fig. 8—The framework from the interior of the barn. Note the clean-cut appearance afforded by welded fabrication.

with conventional frame materials on the longer clear-span structures. From a labor standpoint a site-welded steel frame can be fabricated and erected in much less time than any other type.

On-the-Job Fabrication

The roof trusses were fabricated wholly by downhand welding. The procedure was as follows: the bottom chord angle was placed on the bench, and the strut members were located at right angles to it in their proper positions and welded in place. The top chord angles were then placed and welded. The only flame-cutting necessary (other than cutting members to length) must be performed on the eave ends of this angle. This cut may be seen in Fig. 4. Note how one leg of the angle is beveled slightly so that the two chord angles may be welded together for about 4 in. at the eave end. A gusset plate is inserted at the eave end, as pictured in Fig. 4, and welded in place.

The connection at the ridge of the roof truss is shown in Fig. 5. Here the top chord angles are welded to a $^{3}/_{16}$ in. gusset plate, and vertical and diagonal struts are also welded to the same gusset. The other struts are welded directly to the chord angles. After one side has been completed, the truss is turned over. Additional chord angles are welded on the other side so that all of the chord members will be paired angles. Clips are now welded on the top chord angles to hold the purlins in place as well as to tie the chord angles together at points between the eaves and ridge gussets.

A Truss in 2 Hr

A completely welded truss is pictured in Fig. 6. The finished truss weighs approximately 293 lb and was readily fabricated in two hours. One welder by exerting extra effort was able to fabricate a truss in 65 minutes. The truss shown is for a 25 ft span and is built to have a roof slope of 4 to 1. It is also designed to carry a roof load of 10 lb per sq ft with a factor to take care of a snow load of 30 lb per sq ft or a total roof load of 40 lb per sq ft.

The site-welded building frame was assembled by placing a sill angle on anchor bolts set in the concrete foundation. Some of these bolts also served as column anchors. After the columns had been erected and plumbed, the eave angles were welded in place. When the framework had been erected to the eave angles, the trusses were then set in place.

The purlins were erected simultaneously with the trusses using a 6 by 6 by 18 ft gin pole for the hoisting purposes. After having been erected

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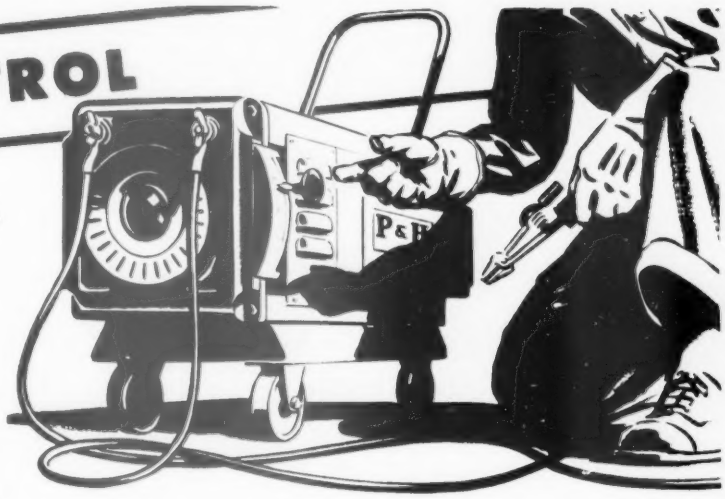

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P&H Model WA-200
Arc Welder
30-285 Amperes
Capacity

Yes, for downright simplicity — for easy operation . . . for better welding results . . . for thrifty operation — this P&H machine is in a class by itself! Feature for feature, it's your best buy — for day in, year out faithful service.

WSR (Welding Service Range) ratings which tell the exact amount of *usable* welding current — from minimum to maximum capacity. "Visi-matic" calibration — enables you to select instantly the correct current for each of the three classes of electrodes.

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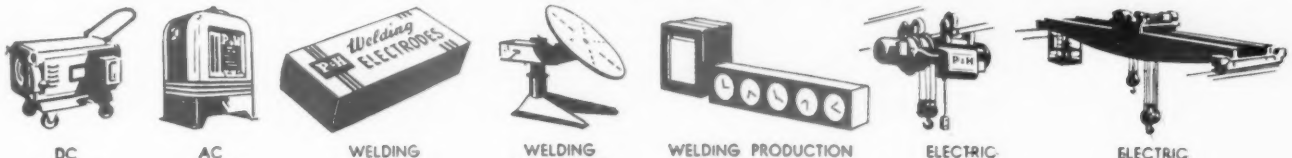

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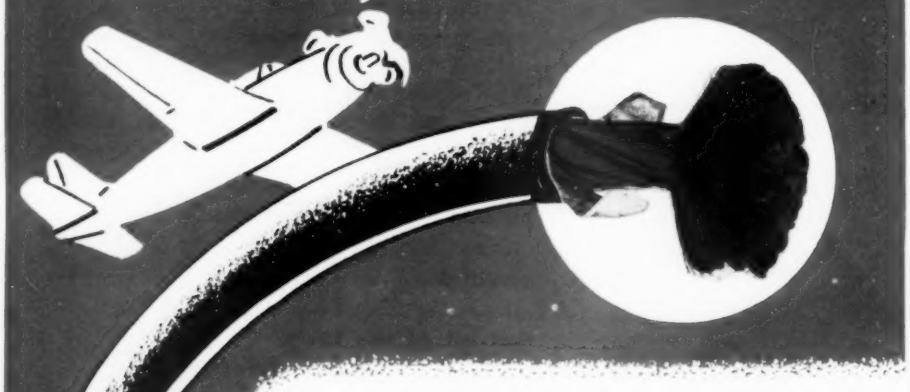
and plumbed, trusses were welded to the columns and eave angles. One purlin was welded to the top and another to the bottom of each truss.

Table I—Welded Steel Framing for a Building 25 by 108 ft (27,000 cu ft)

Item	No.	Time per Item	Total Man-Hours
Fabricating Time			
Column	22	18 min	6.6
Door jamb	6	11 min	1.1
Studs	4[1]	52 min	3.5
Studs	29[2]	9½ min	4.6
Roof truss	10	2 hr	20.0
Erection time			132
Total man-hours			167.8

[1]Channel, 4 in., 5.7 lb [2]Channel, formed steel, 16 gauge

EXTRA SPEED with BURDOX Extra-Flex CABLE



Thousands of twisted wires properly shaped provide extra-flexibility. Less tiring for worker to handle.

Tough construction offers greater resistance to abrasion, oil and water. Less time out for repair.

Bright copper wires of hair width sizes provide high conductivity. Steadier power on the job.

Heavy live rubber jacket and heavy tape wrapping protect wires. Prevent "shorts" and breakdowns.

With BURDOX Extra-Flex CABLE you get the extra speed that means more welds completed per man-hour. Because of its abundance of hair-thin copper wires it delivers a full steady stream of power. Easy on the welder because it coils readily, this cable means less fatigue and better welds. You get many exclusive production advantages with Extra-Flex Cable, yet it costs you far less than you would expect for cable of its high quality. Immediately available in sizes from 6 to 4/0 from all welding supply distributors.

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Burdox Portable Cylinder Trucks carry the load!

Not only handle cylinders with ease, but make a completely portable welding or cutting outfit. Provides a place for tools and tips. Streamlined all welded steel construction. Large safety wheels. Inexpensive, too!

The welding of the frame was now completed by putting in the remaining roof purlins, the strut tie angles and angles for wind and sway bracing. The completely framed structure is pictured in Fig. 7.

The building is now ready for the addition of studs, window sills, door jambs and similar structural features which must be set in any framed structure before the job is ready for further steps toward completion. On this particular building 4 in. steel studs formed from 16 gauge stock were used for the most part. These studs were prepared for erection by welding a steel plate over one end. This plate was similar to that used on the columns; however, it did not have the flame-cut hole in the center as provided for a means of fastening the column to the anchor bolts. In addition, four rolled steel studs were used because of out-of-the-ordinary door locations.

The studs were held in place by welding them to the sill and eave angles on 4 ft centers. All of the welds on the building with a few exceptions are relatively short, intermittent welds.

Roofing and Siding

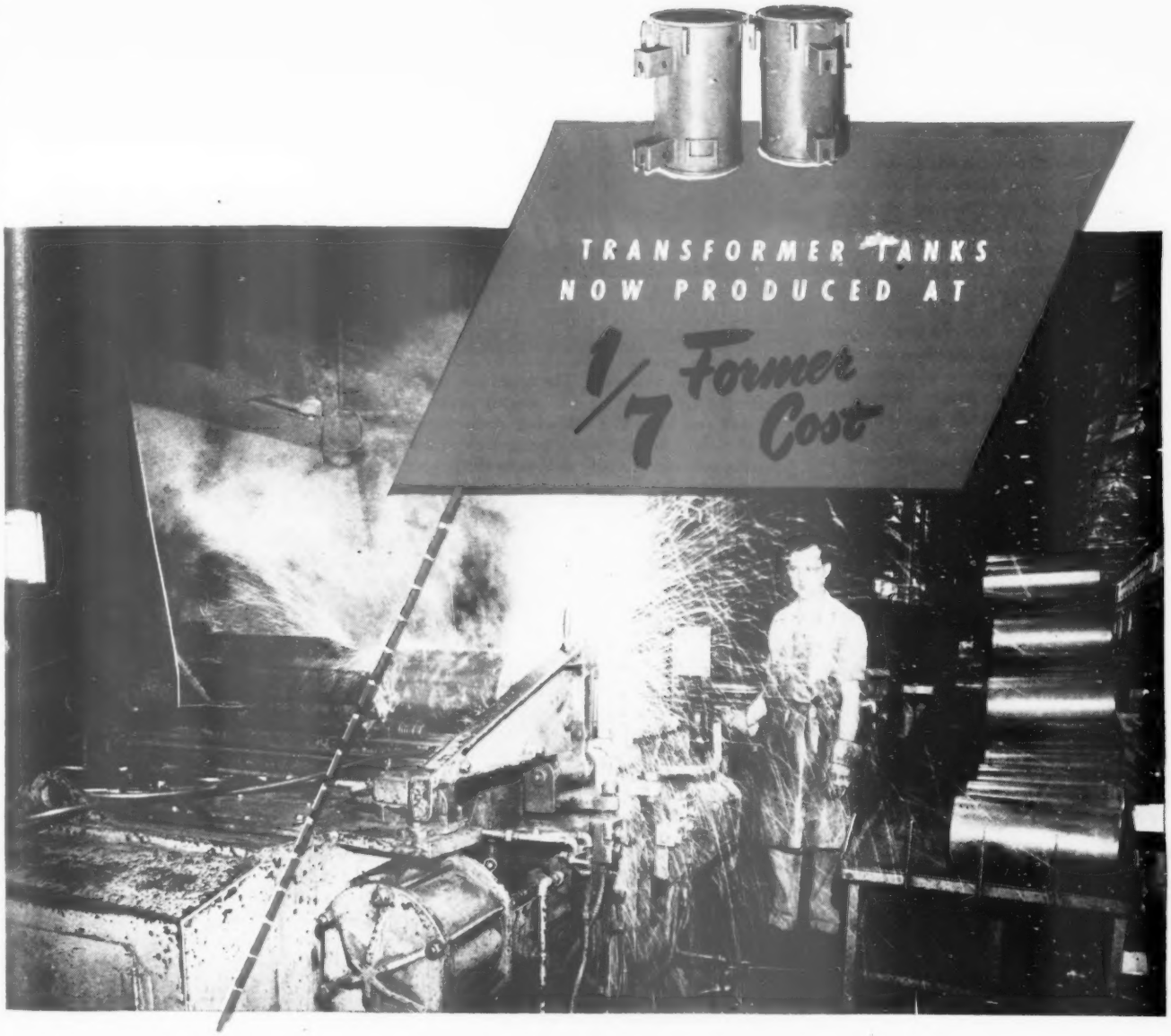
When the framing features have been finished, the structure is now ready for siding. In this instance a 24 gauge galvanized sheet-steel siding was used. Such a siding is available in minimum lengths of 5 ft plus 1 ft multiple additions to a maximum of 12 ft. This makes it possible to use this type of siding with nearly any stud spacing or bay length. Galvanized stove bolts were used to fasten the siding to the studs. Had wood studs been used, lead-headed nails would have been the probable choice.

A standard mill product, galvanized steel roofing sheet, was usd to cover the building. To meet the roof-loading requirements with a 4 ft purlin spacing, a 26 gauge sheet was used, though experience has shown that 24 gauge would probably be preferable. Should a wood deck built-up roof be the desire of the customer, the steel purlins would probably be replaced with more closely spaced wood purlins.

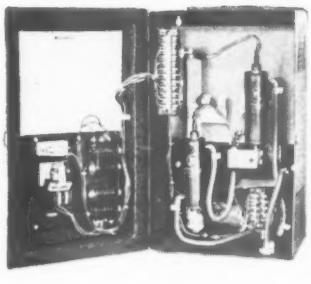
Man-Hours Involved

Table I gives the data on the man-hours needed for preparation of various items of the steel frame and also the man-hours required for the erection of these members.

The finished barn (Fig. 1) is an indication of prosperity on the farm. And when the countryside is dotted with many similar site-welded steel frame barns, rural job welding shops will find prosperity, too.



BY RESISTANCE FLASH WELDING WITH ELECTRONIC CONTROL



WESTINGHOUSE WELD-O-TROL is now being profitably applied to control resistance flash welding operations in scores of plants. Ignitron tubes, operating as electronic contactors, replace mechanical methods in making and breaking currents rapidly with no arc, no noise, no moving parts.

This case history is typical of the highly satisfactory results being obtained daily with electronic control on resistance flash welders.

Finished manufacturing cost of these metal tanks was cut to 1/7th of the cost incurred by former methods of welding. This reduction was effected by the elimination of a fitting and tacking operation; also the elimination of a cleaning and grinding process which had been necessary to hold the welded tank to the close tolerances required.

To learn how electronic control can be profitably applied to *your* flash welding operations, contact your nearest Westinghouse office. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-21365

Westinghouse

Electronics at Work

On the Job

Pressure-Welded Tubing

BOILER tubing, tailor-made to any desired length, is being fabricated from standard-length tube stock by the use of oxy-acetylene pressure welding. Continuous tubing up to 95 ft in length has been produced. Production delays can now be avoided since tube stock of suitable length is readily available.

In welding with this process, squarely cut surfaces are butted together under pressure. While the pressure is maintained, a ring of oxy-acetylene flames (see picture) heats the joint to a high temperature but below the melting point of the steel. Increased pressure is then applied and continued until upsetting of the joint occurs, producing a weld of high quality.

The work is clamped in the machine by means of two split jaws. The ring-type heating head is shown between the jaws in the accompanying close-up of the operation. The control valve for gases is on the front of the machine. The hydraulic pressure is applied to the clamping and push-up pistons by a pump mounted at one side of the machine.

The ends of the tubing are prepared for welding by a simple cut-off operation on a lathe. In this manner, clean, squarely mated edges are produced. Such careful edge preparation is necessary for making consistently strong welds in tubes subject to high temperatures and pressures. With the two lengths of tubing clamped into the machine, the initial pressure is applied and the welding flames are lighted. During the heating, the welding operator positions the welding head directly over the joint. A slight lateral movement of the head during the last few seconds prevents any local overheating or excessive surface fusion. The pressure on the joint is controlled by a helper at the pump.

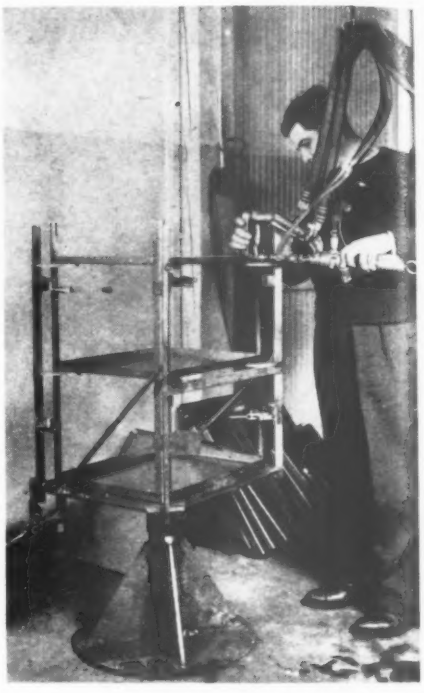
Both heating and pressure are maintained until plastic upsetting occurs. The weld is completed when a predetermined amount of shortening has occurred in the workpiece. The beginning of such a plastic upset is shown in the picture. The work being welded here is carbon-steel tubing with a 2 in. OD. An initial pressure of 930 psi is gradually increased to 2,200 psi to upset this material. The tubes are stress relieved by reheating the welded areas to a dull-red heat and allowing them to recool slowly in air. After being welded and stress relieved, the pipe is bent to the proper shape and is then ready for installation in the boiler.

Speeding Reconversion

SPOT welding with automatic or semi-automatic equipment can be employed during the reconversion months to get certain types of products on the market with much greater speed than has heretofore been possible, it was shown by the recent venture of a midwest cabinet manufacturer. With the aid of assembly spot welding, the company was able to have a trial lot of 5,000 all-steel utility tables (for domestic, commercial and industrial uses) in retailers' hands within about five weeks after the project had been authorized.

Portable-gun spot welding was the method which permitted this rapid production without the expensive investment in dies, jigs, fixtures and other equipment usually needed for quantity runs. The fabrication was carried out in the job welding department of the Progressive Welder Co., Detroit.

Each table consists of four legs and three shelves, all components being 16 gauge steel stampings. The simple sections were assembled with a total of 24 spot welds—two spots on each leg at each shelf. When combined with interlocking of the members, this fastening method produced a completed table of exceptional strength and rigidity.

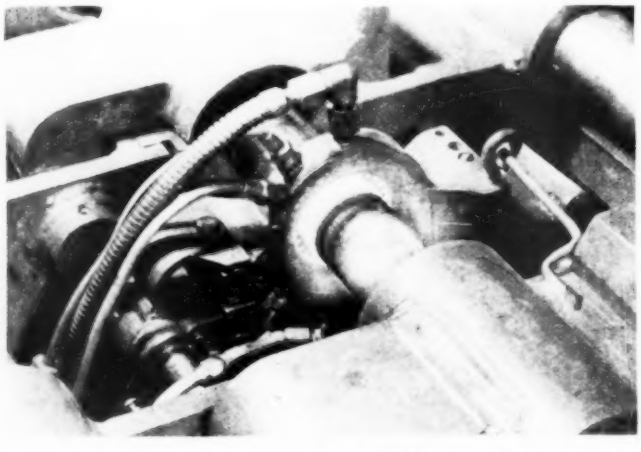


Assembly spot welding one of a 5,000 lot of all-steel utility tables. A portable welding gun and a simple clamp-type fixture enabled completion of this high-production run in five weeks.

A standard C-type portable resistance-welding gun was used to make the spot welds. Only a single clamp-type rotary work-holding fixture was necessary to obtain a production speed of 16 tables per hour with one operator.

Army Welding School

PUTTING aside the Garand rifle for the weldor's arc and torch, GI Joe is catching up with the latest welding methods and learning all about the most recently developed materials and equipment at Warton American Technical School, England.



Courtesy, The Linde Air Products Co.

Close-up of 2 in. tubing being pressure welded. The slight thickening in the vicinity of the joint shows that plastic upset has just begun.

Courtesy, European Theater Office of Information and Educat

Soldier-students are brought up-to-date on the latest technical advances in welding at WATS—Warton American Technical School, England.

This school is being operated by the Army as part of its vast educational program in Europe.

The school covers an area of 45 sq miles and has 700,000 sq ft of floor space devoted to the most completely equipped technical shops in the world—or so says the Army. The equipment represents an outlay of $15,000,000.

The welding section, under the direction of Mr. J. B. Bellon, conducts an eight weeks' course covering theory of welding (all phases), mechanics of welding, stress and materials, structure. The practical work is supervised by a staff of approximately 50 technical experts.

Atomic-Bomb Weld Inspection

THE practical realization of the world-shaking atomic bomb was made possible only by the finest demonstration of teamwork in the history of the world. In a race against time, many experts in many fields gave their fullest assistance and cooperation. An interesting example is provided by the X-ray inspection of the thousands of lineal feet of welding done at the Hanford, Wash., division of the project where a giant plant was constructed for the production of the new element, plutonium.

The X-ray inspection program required was one of the largest ever performed. Furthermore, it was a field job, located in a desert waste where ice in winter and heavy wind and dust storms in summer had a devastating effect on delicate equipment. The site was miles from supplies and had only construction camp accommodations and untrained labor on which to draw. And yet laboratory quality had to be obtained—quality which normally would have been possible only under the most ideal conditions.

Triplett & Barton, Inc., Burbank, Calif., the firm selected for this exacting work, found it necessary to design and manufacture special jigs, X-ray coolers, expansion tanks, power transformers, magnetic and contoured film holders and many other special devices. In addition, a new type of film was created and manufactured for this sole use by the du Pont Corp.

Working 24 hours a day, the company's specialists succeeded in their task of X-raying the thousands of lineal feet of welds at Hanford. More than 15 years of successful X-ray experience, a highly skilled technical and engineering staff and many special manufacturing facilities all went into this little known phase of the big atomic-bomb project.

Moving Big Welded Tanks

RECENTLY 25 welded steel petroleum storage tanks were moved from one side of the island of Puerto Rico to the other, over a stiff mountain range. Each tank is 40 ft long, 12 ft in diameter and has a storage capacity of 25,000 gallons of high-octane gasoline.

Moving them over the mountain range was quite a chore. It was accomplished by the Ponce Trucking Corp., which owns and operates a fleet of 25 trucks and tractors. Powerful White tractor units and rugged 27 ft semi-trailers successfully carried out the difficult assignment.

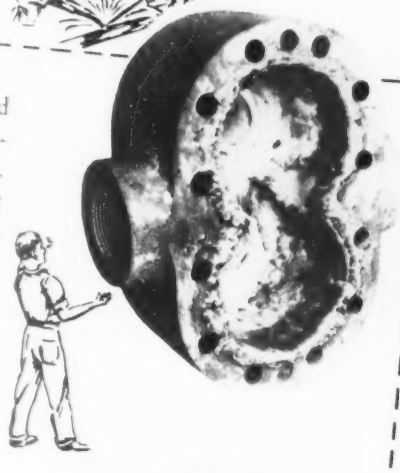
WITH TITAN

SALVAGE WORN PARTS

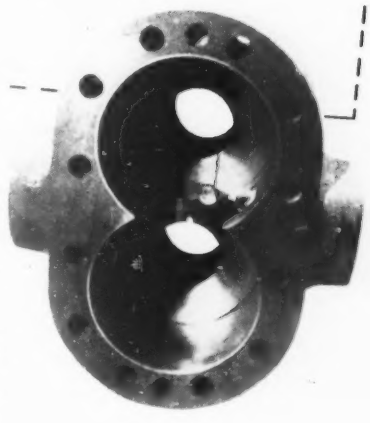
ELIMINATE POROUS WELDS

MANGANESE BRONZE

Excessive wearing out of round in both chambers necessitated scrapping of these oil pump bodies . . . until TITAN Manganese Welding Bronze was recommended for building up the worn bearing surface. After machining, no porosity was found in the bronze built-up surfaces.



The work was done on the welder's bench . . . without preheating, except from the torch as the welder worked on these oil pump bodies.



The welding qualities of TITAN'S Manganese Bronze are such that even the most inexperienced welder can produce sound welds, free from porosity, and possessing physical properties unmatched by welds from other rods.

TITAN'S free-flowing Bronze Welding Rods are Doubly-Deoxidized to protect against formation of gas and oxides . . . give the best results for all acetylene welding and brazing applications. Literature on request.

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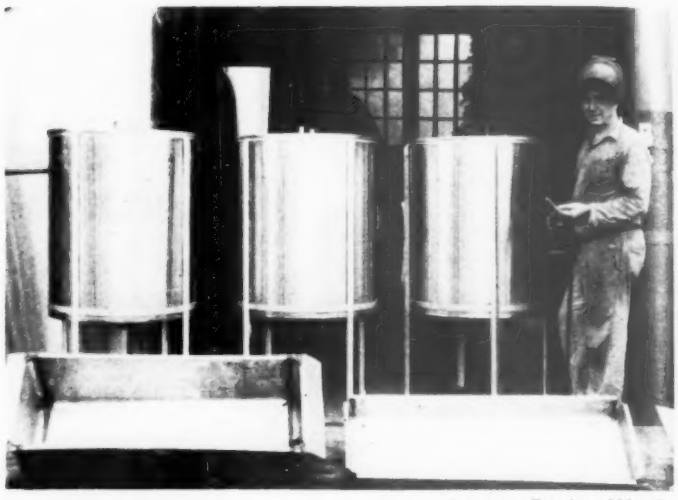
Arc Welding Stainless

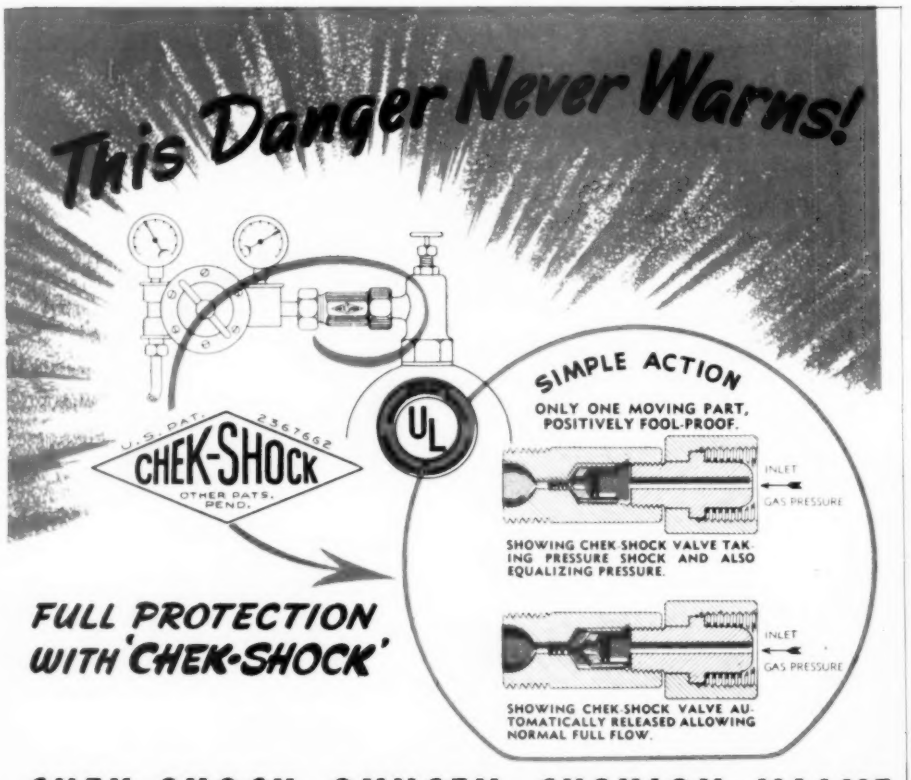
THIN GAUGE stainless-steel sheets can be successfully arc welded, a Philadelphia fabricator, A. M. Williams, has proved. He is using an a-c welder to fabricate milk storage tanks from 16, 18 and 20 gauge stainless-steel sheets. In addition to the 100 to 2,000 gallon storage tanks, a large number of stainless-steel troughs are also being fabricated on the same contract.

Williams believes that he is one of the first to fabricate stainless-steel in this manner on a large scale. He admits that in his many years of welding experience this is the first time that he has ever tried arc welding on stainless sheets. "These all-welded tanks have been a remarkably satisfactory test of arc welding, not only on stainless steel but on rigid specifications work," he says.



A. M. Williams, Philadelphia fabricator, with newly welded 16 gauge stainless-steel milk storage tanks and troughs. The smaller tanks hold 100 gallons. The large tanks in the background hold 2,000 gallons.

Courtesy, Ergolyte Mfg. Co.



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SOFTLY controls the vicious "jolt" of high pressure oxygen gas, thus eliminating regulator repairs and preventing possible injury to operators.

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- Will prevent unnecessary internal wear in regulator *(as NOT necessary to release control screw before opening tank valve).*

This PROVEN automatic safety device cushions the initial "blast" of pressure when tank valve is turned on, (this uncontrolled surge which strikes like a hammer is the direct cause of most damaged regulators and accidents), when pressure slowly bleeds and equalizes then CHEK-SHOCK allows a full flow of oxygen.

PRICE IS LESS THAN ONE REPAIR BILL

1. STANDARD COUPLER—for all standard size welding type oxygen regulators.
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4. SCREW TYPE COUPLER—for removable inlet stem regulators (¼" pipe) available in standard, light, or heavy capacities.

$6.00 ea.

5. FOR HYDROGEN—left hand thread coupler. We also make Medical Chek-Shocks for all types of medical regulators and tank fittings (chrome plated).....$7.00 each

SEE YOUR DISTRIBUTOR OR WRITE

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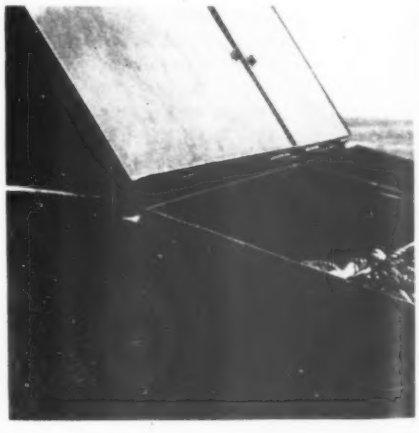
FOWLER CALIF.

Tool Box Seal

By Charles C. Lynde

THE weldor for an oil-drilling contractor built in a drain for a steel tool box which intercepts all leakage past the cover joint and effectively protects the contents of the box from rust and moisture. A small notch was first cut in the top of the box at the line where the twin covers are hinged, and a light channel was welded across the box (see picture). A second channel was then welded from the transverse member to the lower edge of the box where the two covers overlap.



The channel just below the hinges provides a drain for this steel tool box. A second transverse channel serves to catch any leakage past the sloping joint and completes the waterproofing.

The edges of the covers project slightly below the steel sides of the box; drip is thus directed into the channels and any wind blowing of rain drops is prevented. The transverse channel is allowed to project slightly beyond the sides of the box to carry drip beyond the side plates.

In addition to serving as a drain, the transverse channel forms a stiffener for the cover section, enabling lighter sheet steel to be used.

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BLACK ARROW POLICY

For established jobbers, the new Black Arrow line offers many advantages:

1st As a Black Arrow Jobber you are backed by a young, progressive organization that believes the welfare of its distributors to be its prime obligation and responsibility.

2nd You enjoy the benefits of a sales policy which is unique in the welding industry. This policy, outlined in our new Sales & Distribution Policy brochure, is so administered that it always works to your advantage and best interests.

3rd You carry a standardized line of highest quality products which combine absolute reliability with universal application. This line will be constantly improved and expanded.

4th You receive cooperation and support on matters of local and national advertising and sales promotion.

LET US HEAR FROM YOU

If you're an established jobber who may be seeking a new source of supply, now or in the future, write us today. One of our Field Engineers will be glad to meet with you and describe our proposition in detail.

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★ PRODUCTION

Silver-Brazed Brake Cylinders

All-steel cylinders fabricated by silver brazing beat magnesium castings in strength and cost, matched them equally in weight.

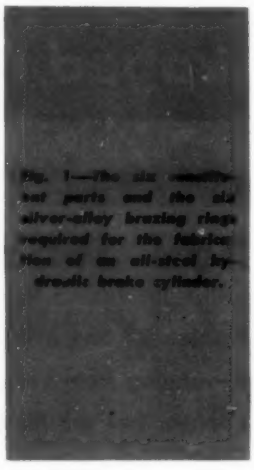


Fig. 1—The six machined parts and the six silver-alloy brazing rings required for the fabrication of an all-steel hydraulic brake cylinder.

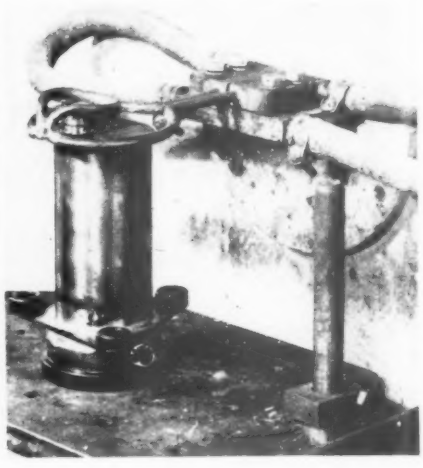


Fig. 2—Induction brazing was employed in the fabrication of the cylinder. This picture shows how the end cap was joined to the tube and the threaded lug to the cap in a single operation.

IN THE design of every metal product a constantly recurring problem is the question of whether to use castings or fabricated and assembled parts.

Theoretically, the casting process should be fundamentally most desirable from a cost standpoint. It turns the metal from the ingot into the proper shape in only one operation, whereas fabrication from sheet, rod, wire or tube involves numerous steps: rolling, annealing, pickling, drawing, extrusion, etc. In actual practice, however, as every designer knows, it is impossible to generalize. Every case is special; every job is a different problem and has its own answer.

Magnesium vs. Steel

One interesting example is an airplane hydraulic brake cylinder that was made first from a magnesium casting and then of fabricated steel. The casting was bored, fitted with a steel sleeve and then machined to finish the assembly. It made a lightweight cylinder, but porosity caused many of the finished assemblies to fail under the rigid "leaker" tests. These failures represented a complete loss of material and labor, neither of which could be reclaimed.

To avoid porosity, an all-steel cylinder was fabricated from thin-wall tubing by joining the component parts with a low-temperature silver-brazing alloy (AMS-4770). This unit was far stronger than the cast assembly and yet well within the weight limit. The cylinder was produced at a much higher production rate and lower cost, and it met without difficulty the preliminary 100 psi air test and the final 600-800 psi oil pressure test required. The few leakers that did occur were easily repaired to meet the requirements, and no fabricated cylinders had to be scrapped.

Joining the Assembly

Fig. 1 shows the six parts of the assembly and the silver-alloy wire rings that were preplaced at the various joints. The cylinder tube, bracket and bottom part were set in a positioning jig with the silver-alloy rings in place. Silver-brazing flux was then liberally applied to all parts with a brush.

The fluxed assembly in the holding jig was raised to the proper brazing temperature by means of an induction heating coil. The operator switched on the current and turned it off when the signal light flashed. Heating time for all three joints was 30 seconds. The brazed assembly was dipped in a water bath to remove excess flux.

End and Side Fittings

The end cap was induction brazed to the cylinder tube and the threaded lug to the cap as shown in Fig. 2. Note the silver-alloy ring in place at the bottom of the lug. Another ring of the same material was preplaced inside the cap. The brazing time was 22 seconds.

In the final operation, the side fitting was brazed to the cylinder in a time of 10 seconds. The total heating time required for all three operations was 62 seconds.

The fully assembled brazed cylinder, cleaned and ready for use, is shown in Fig. 3.

* * *

The illustrations were obtained through the courtesy of Handy & Harman, New York City.

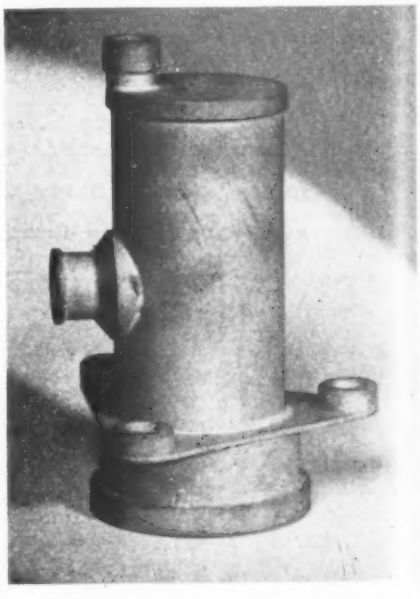
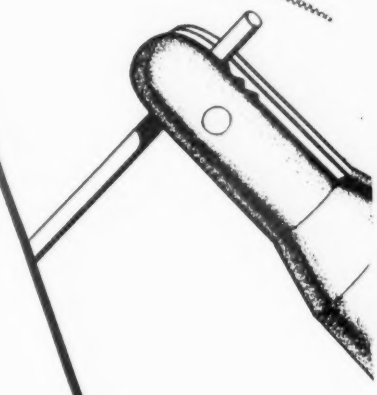


Fig. 3—The finished brake cylinder—cleaned and ready for use in an airplane.

PAGE *Welding* ELECTRODES

HELP YOU TO KEEP WELDING COSTS

DOWN



• Type and cost of current used—welding position—fit-up—efficiency of the operator—all these affect the over-all cost of production welding. Quite as important as any of these are the type, size and make of electrode used. And that's where PAGE comes in. Here's why.

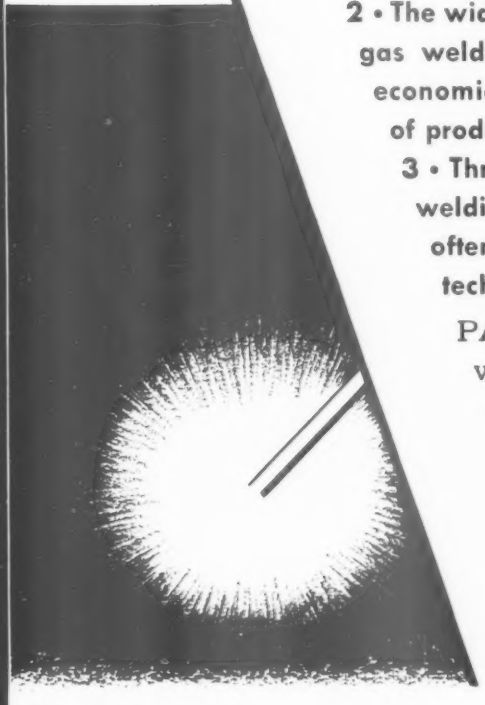
1 • PAGE electrodes are of uniformly high quality. Experienced welders take that for granted.

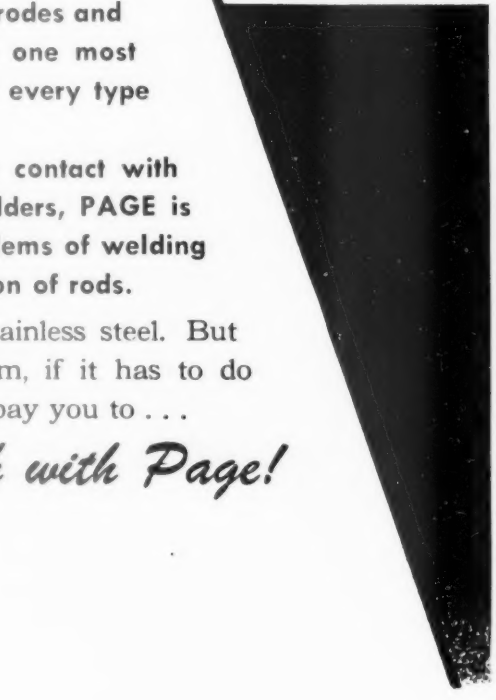
2 • The wide range of PAGE electrodes and gas welding rods includes the one most economical rod for practically every type of production welding.

3 • Through long and close contact with welding engineers and welders, PAGE is often able to help on problems of welding technique and the selection of rods.

PAGE specializes in stainless steel. But whatever your problem, if it has to do with welding, it will pay you to . . .

Get in touch with Page!





ACCO Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Pittsburgh, Portland, San Francisco, Bridgeport, Conn.

ACCO TRADE MARK

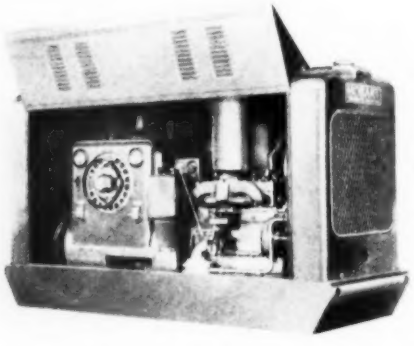
PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

New Products to Use

Engine-Driven Welder

★ A lightweight but husky 200 amp engine-driven arc welder is the first post-war model to be announced by Hobart. Enclosed in a steel canopy with hinged side panels and powered by a 26 hp four-cylinder gasoline engine, the unit has a welding range of 40 to 275 amp. "Multi-range Dual Control" of welding current makes it easy for the operator to adjust voltage and amperage relationship to the fine degrees that are required on many welding applications. The control wheel on the front of the generator-control panel corresponds to the station selector of a radio receiver, and the volt-ampere adjuster located inside the wheel corresponds to the radio volume control.

Ten ranges of welding and one hundred steps of volt-ampere adjustment in each range make available 1,000 combinations of open-circuit voltage and welding current for any desired arc characteristics. If desired, the volt-ampere adjuster can be removed from the control panel and used with an ordinary extension cord to permit the operator to adjust the welding heat right at the work. This remote control feature eliminates repeated trips between the welding work and machine. The standard equipment also includes a mercury-type idling device to cut down on fuel consumption and engine wear. **The Hobart Brothers Co.**, Hobart Square, Troy 1.



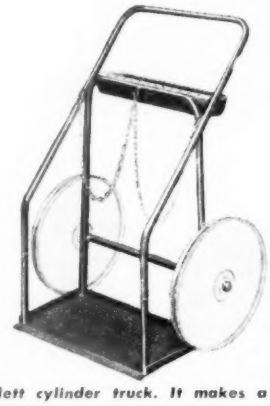
Hobart stationary engine-driven arc welder with newly designed steel skid mounting. Mountings on a two-wheel, pneumatic-tired trailer or on 16 in. shop-type wheels are also available.

Tungsten Electrodes

★ "Cleve-Tung" polished electrodes are actually 99.9% pure tungsten, states manufacturer, and hence enable the user to meet very close tolerances. Contact is said to be better, and the weld is cleaner, without inclusions or additions, because the rod has no carbonaceous or other kind of coating. The resulting freedom from contamination is a virtue particularly important in the welding of magnesium and aluminum. **Cleveland Tungsten, Inc.**, 10200 Meech Ave., Cleveland.

Cylinder Truck

★ Burdett's new "DeLuxe" cylinder truck renders a gas welding or cutting outfit wholly portable. The truck is easy to load, properly balanced and easy to move from place to place. Features are: (1) a streamlined one-piece safety handle requiring only one hand to push; (2) a streamlined tip rack and tool holder providing a place for every tip and tool; (3) a one-piece upright of reinforced all-welded construction; (4) a chain to hold cylinders rigidly in place; (5) one-piece steel safety wheels; (6) beveled edge on front of platform to make it easy to roll the cylinders on or off; (7) side rail around three sides of the platform to prevent the cylinders from slipping off or rubbing against the wheels. **The Burdett Oxygen Co.**, 3302 Lakeside Ave., Cleveland 14.



Burdett cylinder truck. It makes a gas welding or cutting outfit portable.

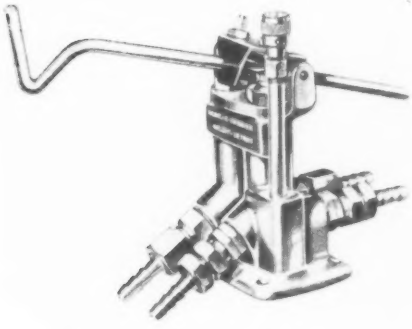
Protective Compound

★ "Dipwrap" is a resilient hot-dip protective compound to provide protection for sharp-edged metal objects, gears, pinions, etc., against the effects of moisture and rough handling. It is quickly applied by simply dipping the object to be protected into a container of the melted compound. The coated part is then allowed to cool for 5 or 10 seconds and cased for shipping or storage. The saving in labor and material, manufacturer states, will sometimes average as much as 80% over the conventional slushing, wrapping and cartoning operations.

"Dipwrap" is easily removed when the part is required for use by means of an impregnated, non-wicking string which serves as a rip-cord to start the initial peeling. **Paisley Products, Inc.**, 1770 Canalport Ave., Chicago 16.

Improved "Gasaver"

★ A new Weldit "Gasaver" is said to cut oxygen and acetylene consumption by as much as 50% and has two important features not found in earlier models. These are a new, non-smoking pilot light and a lever rod quickly adjustable as to length so that any size or weight of torch will automatically operate the closing valves. Between welds, the torch is hung on the lower rod to shut off the intake lines for both fuel gas and oxygen. **Weldit, Inc.**, 628 Bagley Ave., Detroit 26.



Model "E" Gasaver. It eliminates the danger of open flame, regardless of the weight of torch used.

Trucks and Accessories

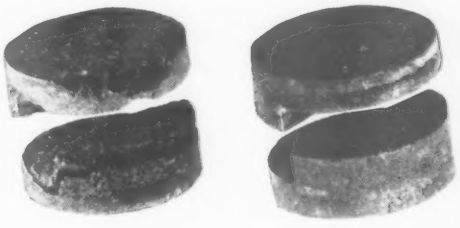
★ A new type of industrial truck, equipped with deep stake pockets at each corner, makes possible the conversion of the truck from one type of load carrier to another. It is thus possible to set up quickly any type of truck needed to solve a particular load-carrying problem in the plant. All that is needed is the one basic type of truck plus the accessories which will change it into a box truck, leaf truck, shelf truck, rod and tube truck or any of the trucks shown in the accompanying picture. **Market Forge Co.**, Garvey St., Everett 49, Mass.

Market Forge standardized industrial truck and accessories. The basic floor truck may be quickly converted to any of the other types of carriers shown.

4 to 5 Times LONGER LIFE

Dressing Time REDUCED BY TWO THIRDS

and here's the proof!



UNTREATED **TREATED**

(Actual unretouched photo)

At left . . . Ordinary carbon brazing tips ready for the discard after only 500 operations. *At right* . . . Stackpole "F" treated brazing tips still ready for a lot more use AFTER 1300 OPERATIONS on the same job!

CARBON BRAZING TIPS

...with the famous Stackpole "F" Treatment

STACKPOLE'S recently developed "F" treatment for its Carbon Brazing Tips has resulted in units that operate at temperatures above red heat, require dressing far less often, and increase tip life four to five times that of untreated carbon by minimizing oxidation.

"F" treated Tips can be produced in practically any required shape or size. Their resistance to cracking or spalling permits the application of more radical temperature changes than is possible with any other material.

OTHER STACKPOLE PRODUCTS

BRUSHES
(All types for all rotating electrical equipment)
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(Carbon, graphite, metal, rare metal, and composition types)
PACKING, PISTON and SEAL RINGS
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POWER TUBE ANODES
WELDING CARBONS, etc., etc.

STACKPOLE CARBON COMPANY, ST. MARYS, PA.

EXPORT: Stackpole Carbon Co., 254 W. 34th St., New York 1, N. Y., U. S. A.

SAMPLES

. . . sent for test. State size and shape. Mention company affiliation.

STACKPOLE

SPEED RECONVERSION

WITH COMPOSITE DIE FABRICATION BY WELDING

(Above) Composite-Fabricated Die. The Base is Mild Steel, the Cutting Edges, "Hard-As-Welded" Deposits of Eureka Oil-Hardening Tool Steel Electrodes.

Eureka Tool and Die Welding Electrodes, for composite die fabrication, facilitate planning and effect speedy results in reconversion. Plain carbon or low alloy NE steels are used as a base and weld deposits of the various Eureka Tool and Die Welding Electrodes constitute the cutting edges or working areas. Units so constructed efficiently replace those constructed entirely of tool steel.

ELIMINATION OF HEAT TREATMENT

Deposits of Eureka Electrodes, which are "hard-as-welded" eliminate the need of complete heat-treatment after welding.

COSTLY MAINTENANCE AVOIDED

The ability to produce a composite tool or die results in a working surface of any desired characteristic with a resilient core.

CONVERTING INTO COMPOSITE UNITS

Convert existing tool steel die sections into composite units to meet unusual conditions.

MACHINING IS FINAL OPERATION

In composite fabrication by welding, finish machining, drilling, etc., can be done as final operations.

INSERTS ELIMINATED

Composite fabrication by welding eliminates the use of inserts, which are often too costly, unsatisfactory or impractical.

MULTIPLE APPLICATIONS

In composite fabrication by welding, it is practical to weld two, three or four types of unlike materials on one die unit to perform individual functions.

EUREKA STEEL FOR EVERY TOOL AND DIE NEED — ELECTRODES

Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

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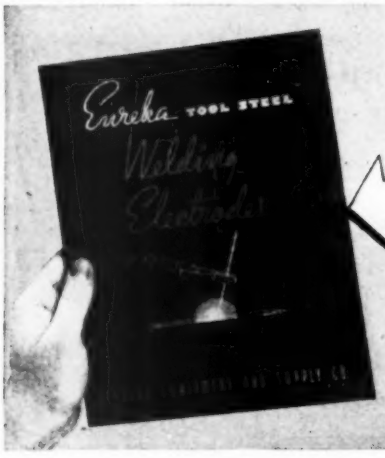
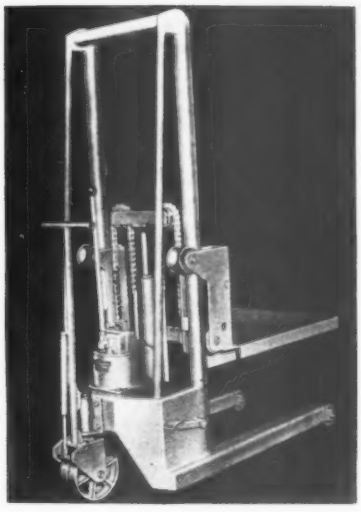


WRITE FOR YOUR COPY TODAY

This manual will help you save man-hours, conserve material and minimize production delays by outlining methods of repairing and compositely fabricating tools and dies, as well as correcting design and rectifying errors. Send for your copy today. It is fully illustrated with typical welding applications.



Lyon-Raymond 2,000 lb capacity hydraulic "high-lift" truck. It may be used for transferring materials as well as for stacking and tiering.

Hydraulic Lift Truck

★ The new 2,000 lb capacity Lyon-Raymond hydraulic "high-lift" truck employs the same welded tubular and formed-plate construction used in this manufacturers' 1,000 lb capacity model. It weighs about a third less than conventionally designed portable elevators and is suitable for transferring materials as well as for stacking and tiering. The standard stock model has a platform 30 in. wide by 36 in. long with an elevating range from 6 to 60 in. above the floor. A two-speed hydraulic hand pump may be furnished. **Lyon-Raymond Corp.**, 2451 Madison St., Greene, N. Y.

» «

Mogul "Dot-Weld" Process

The new Mogul "Dot-Weld" process, used to salvage castings, offers an improved technique for filling blowholes. It utilizes the "Quench-Arc" weld machine (a high-amperage, low-voltage unit operating on alternating current) and the "Dot-Weld" pistol—a combination affording depths of penetration from 0.001 up to $\frac{3}{32}$ in. Danger of high temperature is eliminated by a specially designed air-pressure unit built into the pistol, which quenches the electrode and the arc in a constant stream of cooling air.

This process makes possible the low-cost salvage of ferrous and most non-ferrous castings rejected because of blowholes and other defects by providing fast, readily machineable fill-in deposits of aluminum, bronze, nickel, or zinc. The equipment includes the pistol and the 220 volt, 60 cycle, single-phase "Quench-Arc" weld machine. The letter is furnished complete with a stream-lined cabinet, enclosed hinged-top storage compartment, two 15 ft lengths of cable, male and female receptacles, a pair of goggles, heavy-duty ground clamp, 20 ft of air hose with fittings, a wall receptacle and full instructions. **Metallizing Co. of America**, Industrial Division, 1330 W. Congress St., Chicago 7.

(Please turn to page 73)

Strength of Standard Pipe Columns*

By W. F. SCHAPHORST, M. E.

ORDINARY steel pipe often comes in handy for use as columns or struts or for use as push members in transmitting forces. Due to its circular form, a pipe is ideal for these purposes. No shape is stronger than a pipe.

When it comes to "figuring columns," however, it usually takes considerable time to dig around in handbooks, etc., and as a result the use of a pipe is avoided. Or a pipe much too large is used—chosen entirely by guesswork. Worse yet, the pipe may be too small, fail and so be the cause of a costly disaster.

Those who may have occasion to use standard pipes as columns or stress members will find the following simple table and rules of value:

1. Knowing the load that is to be carried and the length of pipe needed, make a guess as to the size of pipe. Column A in the table will help in making the guess as it gives the maximum length of pipe that may be used. For example, never use a ⅛ in. pipe longer than 14.5 in. as an important column. Never use a 3 in. pipe longer than 139 in. as an important column, and so on.

Calculating Table for Pipe Sizes

Size of Pipe, Inches	A (Maximum Length, Inches)	B	C
⅛	14.5	826.4	0.07
¼	19.4	617.3	0.12
⅜	25.0	480.8	0.17
½	31.3	383.1	0.25
¾	40.0	300.3	0.33
1	50.6	237.5	0.50
1¼	64.7	185.5	0.67
1½	75.0	160.5	0.80
2	94.7	126.9	1.07
2½	114.0	105.3	1.71
3	139.0	86.21	2.24
3½	161.0	74.63	2.68
4	181.0	66.23	3.18
4½	202.0	59.52	3.68
5	226.0	53.19	4.32

2. Multiply the length of the pipe in inches (actual length—not figure in Column A) by the corresponding figure in column B of the table. This product should never be greater than 12,000. A product greater than 12,000 means that you have guessed a pipe that is too small. If your product is under 12,000, proceed as follows:

3. Subtract the product obtained in (2) from 19,000. If the difference is equal to or less than 13,000 use it in (4). If the difference is more than 13,000, use 13,000 in (4).

4. Multiply the remainder obtained above (or 13,000) by the figure in column C corresponding with the pipe size. The result is the number of pounds that the pipe will carry as a column, strut or push member. If the result is less than the load to be carried, try again. Use the next larger pipe size, and so on until the proper and most economical size is selected.

Let us now take a specific example to make certain that the above instructions are fully understood. What size of pipe shall we use to support a load of 10,000 lb at a height of 84 in.? Following the above rules, we proceed in this way:

1. "Guessing" the size of pipe from column A shows that 84 in. falls between 1½ and 2 in. pipe. We will try a 2 in. pipe because, of course, it is stronger than a 1½ in. pipe.

2. 84 × 126.9 = 10,650. This is less than 12,000, and we can therefore continue.

3. 19,000 − 10,650 = 8,350. This is less than 13,000 and we may therefore use it in (4). If the difference were 18,350 we would have to use 13,000 in (4).

4. 8,350 × 1.07 = 8,950.

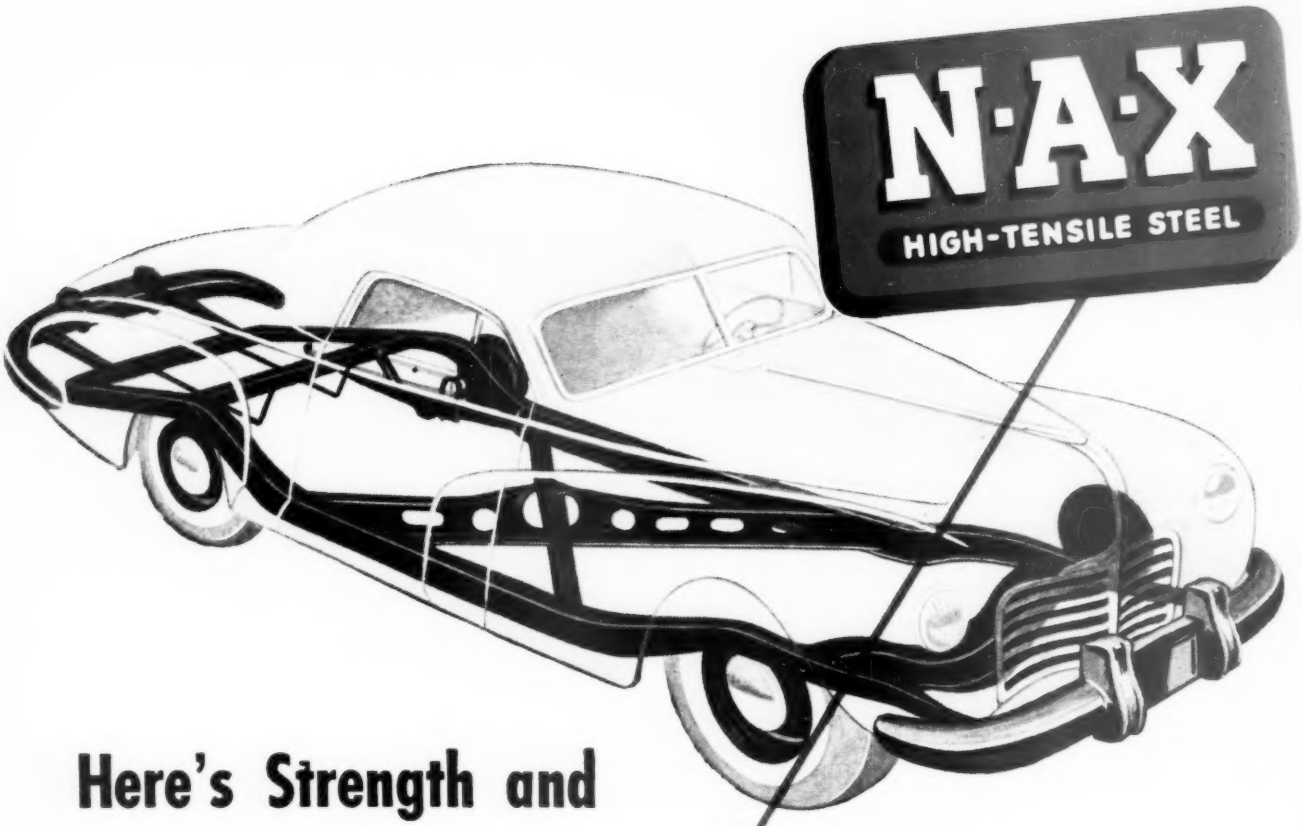
This means that the pipe will support a load of 8,950 lb—less than the 10,000 lb required. A 2 in. pipe is, therefore, too small. We must recalculate, this time trying a 2½ in. pipe. Briefly, the results are:

2. 84 × 105.3 = 8,850
3. 19,000 − 8,850 = 10,150
4. 10,150 × 1.71 = 17,370 lb.

A 2½ in. pipe is, therefore, amply safe to hold up 10,000 lb at a height of 84 in.; in fact, the result shows that it is capable of holding up nearly twice as much as a 2 in. pipe at that height. The small difference in pipe sizes and the great difference in strength make clear the necessity for careful computation and the dangers involved in guesswork.

Don't take chances. Don't guess.

*Based on the well-known and much-used "American Bridge Co. Formula."



Here's Strength and Toughness* to Take the Place of MASS

*Formability, too

N-A-X HIGH-TENSILE steel ties in with the modern trend in the nation's automotive industry away from mass toward lighter, more efficient designs.

Its great inherent strength and toughness—made practical by the exceptional formability of this fine-grained steel—can be applied to cut down deadweight or increase strength in a score of automotive parts. Frames, wheels, spring suspensions, torque arms, engine supports, body parts and bumpers are examples of automotive parts that can benefit by the outstanding properties of N-A-X HIGH-TENSILE steel.

Let's boil it down to this: Where reduced mass and weight are desirable, N-A-X HIGH-TENSILE can cut them down without sacrifice of strength. Where increased strength and durability are demanded, N-A-X HIGH-TENSILE can do the job using the same sections. And where strength combined with exceptional cold-formability is the primary goal, as in the case of bumpers, N-A-X HIGH-TENSILE is outstanding.

GREAT STEEL FROM GREAT LAKES

GREAT LAKES STEEL
Corporation

N-A-X ALLOY DIVISION • DETROIT 18, MICHIGAN

UNIT OF NATIONAL STEEL CORPORATION

New Products

(Continued from page 68)

AISE "Lift Front" goggles. They are attached to a heavy fibre head protector fitting over the forehead.

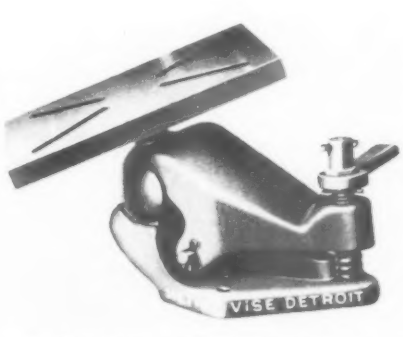
Lift Front Goggles

★ "Eye-Gard Lift Front" goggles are attached to a ruggedly built fibre headgear fitting over the entire forehead. All parts which come into contact with the head are padded to insure comfort, and the elastic headband is adjustable to assure fitting. The goggles are carried on hanger arms and held in position by a tension lock washer and finger nut. They are carried without pressure on the nose or face, can be easily moved up and down and will stay put wherever desired. **American Industrial Safety Equipment,** 397 Bridge St., Brooklyn 1.

» «

Vise Positioner

★ The new Model S Metro positioner permits the angle of tilt to be adjusted almost immediately to suit various assembly operations. The existing vise or fixture is bolted to the slotted faceplate, which is integral with a ball turning in a socket. The two babbitt clamping jaws



Model S Metro positioner. It operates on the ball-and-socket principle and is suitable to hold vises or small fixtures.

hold the ball firmly in the socket yet are so tensioned as to let the ball roll whenever a change in the angle of tilt is desired. Since there are no fixed graduations, the movement may take place at any angle and in any direction.

Pressure of the babbit jaws is actuated by a heavy tension spring and is sufficient to hold the ball in position during assembly operations. The ball is readily responsive, however, to simple hand pressure. An adjustment screw enables the tension of the spring to be adjusted to the character of the work being performed. The positioner is available in two sizes. **Metro-Vise Co.,** 245 Stephenson Bldg., Detroit 2.

» «

Phosphor-Bronze Electrode

★ "Phos-Trode" is a shielded-arc, phosphor-bronze rod made by the manufacturer of "Ampco-Trode" coated aluminum-bronze rods. The new rod, states manufacturer, is the result of months of laboratory experimentation to secure an alloy and coating that would answer the demand for a heavy-coated rod giving easy deposition, correct bead contour, freedom from porosity and lower spatter loss.

Phos-Trode operates on reverse (positive) polarity, direct current. The heavy coating eliminates use of the long-arc technique resulting in the globular transfer of molten metal. Instead the arc is soft, resulting in transfer of the metal by a spray action.

Offered in $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$ and $\frac{1}{4}$ in. sizes, Phos-Trode can be used in all positions—flat, vertical and overhead. A few typical applications are: bearing surfaces, copper brewing stills, bus bars, bushings, bronze-casting repairs, cast-iron repairs, copper-clad fabrications, eccentrics, galvanized iron, bronze gears, locomotive guides, impeller blades, journal bearings, copper piping, caustic pump blocks, bronze ship propellers, copper valve seats, viscose mixers, etc. **Ampco Metal, Inc.,** 1745 S. Thirty-Eighth St., Milwaukee 4.

» «

X-Ray Accessories

★ Improved accuracy in X-ray film processing is made possible by a floating thermometer and an interval timer being produced by **General Electric X-Ray Corp.,** 175 W. Jackson Blvd., Chicago 4. Housed in an all-metal black or ivory finished case, timer may be set for any interval from 15 seconds to 2 hours. The hands are set from the front, and the alarm is wound by giving a lever a quarter-turn downward.

The thermometer, specifically designed for darkroom use, is calibrated in Fahrenheit to show one-degree solution temperature variations throughout its scale.

A double-purpose wetner has also been added to the "Supermix" line of X-ray film developing chemicals. One purpose of this solution is to act as a wetting agent for X-ray developer and refresher; the other purpose is to serve as an anti-spotting, quick-drying rinse.

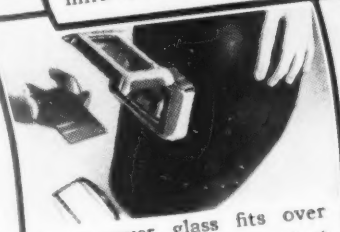
» «

Plate-Bending Roll

★ A plate-bending roll of the pinch type, equipped with 9 in. diam rolls throughout, is announced by the **Webb Corp.,** Webb City, Mo. This machine, Model 6-L, is manufactured in the following capacities: 4 ft of $\frac{5}{8}$ in. mild-steel plate; 6 ft of $\frac{1}{2}$ in. plate; 8 ft of $\frac{3}{8}$ in.; 10 ft of $\frac{1}{4}$ in. and 12 ft of $\frac{3}{16}$ in. plate.

Let Willson-Weld Glass Guard Your Welders' Eyes

Formula for welding eye safety: Willson One-Piece Welding Helmet *plus* green Willson-Weld glass *equals* dependable protection—from heat, glare, metal spatter, ultra-violet and infra-red rays.



Clear cover glass fits over Willson-Weld lens to protect it from pitting. Both lens and cover glass are easy, economical to replace. Helmet covers both front and sides of face and neck.

Look for the WW trademark on each Willson lens. Your assurance that it meets highest Federal specifications. Shade number indicates thickness and density of lens. Simplifies selection.

For help with your welding eye protection problems, consult your Willson distributor or write for further information.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON

PRODUCTS INCORPORATED

Established 1870

227 WASHINGTON STREET • READING, PA., U.S.A.

PUG MILL PADDLE—

Ready for Battle

Ever see how clays, flue dust and other abrading materials raise hob with pug mill paddles? The beating is terrific—edges wear to a frazzle...heavy cast paddles are often discarded in a few weeks. But this pug mill paddle coated with Coast Metals will last about three times as long as uncoated ones, and can be re-surfaced again and again for still more life.

Savings? The same as you get by Coast Metals hard-facing other wearing surfaces—shut down time is shortened, repairs and replacements minimized.

Let Coast Metals Hard-Facing step up the life of your machinery and parts! Pamphlet S-101 gives details. Write for your copy.

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Plant and General Offices:
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Executive Offices:
2 West 45th Street, New York 19, N. Y.

COAST METALS

hard-facing weld rods

MAKE YOUR EQUIPMENT LAST LONGER

Aluminum-Flux

★ A new aluminum flux just placed on the market combines in one formula a flux for aluminum soldering, aluminum brazing, and aluminum gas welding. This flux, Amco No. 4015, can be used with aluminum brazing rods to braze either rolled or cast aluminum or in combination with the proper welding rods to weld either rolled or cast aluminum. In soldering operations, it may be used with aluminum solders or, declares manufacturer, it will do an excellent soldering job with ordinary 50/50 tin-lead solder. It has a relatively low melting point, high fluidity and retains its activity over a wide range of temperatures, this being applicable to soldering, brazing or gas-welding operations.

Should occasion require, Amco No. 4015 may be used to solder, braze or weld aluminum to iron or steel, brass, copper, Inconel, Monel, bronze and other alloys. **American Solder & Flux Co.**, 2152 E. Norris St., Philadelphia 25.

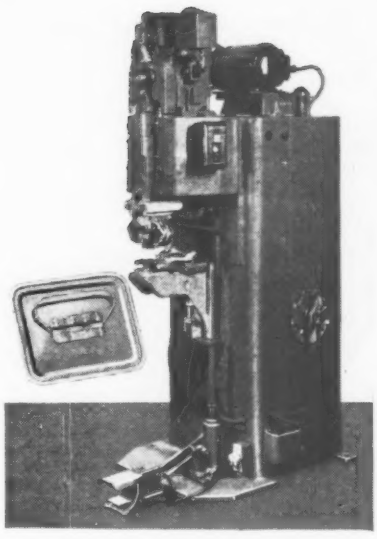
Welded Stools

★ All-welded steel stools, available in five heights and 80 models and having a diversity of industrial and commercial uses, are now being marketed by **Lyon Metal Products, Inc.**, Aurora, Ill. The 80 models, the company asserts, have been designed from a physiological standpoint to meet every posture need of workers to reduce fatigue and so aid materially in increasing employee efficiency. The 26 in. stool pictured, No. 1226, is equipped with an adjustable back and pressed-wood seat (over steel) and steel feet. The back support may be attached to all models.

Lyon 1226 steel stool—one of 80 models designed to meet every posture need in a plant.

Universal Testing Machine

★ A hydraulically operated machine designed for the making of tensile, traverse and compression tests up to 60,000 psi is announced by **Steel City Testing Laboratory**, 8843 Livernois Ave., Detroit 4. The piston and cylinder are a lapped finish and carefully fitted without any packing, allowing for a minimum of friction. The pulling head unit thrust is taken on a large steel ball and socket which allows the head to float. The upper and lower pulling heads are of the conventional type with wedge-type jaws for both flat and round specimens. Holders are also available for shoulder and thread end specimens. A suitable load-regulating valve is provided, and any load can be held for any period at the will of the operator.



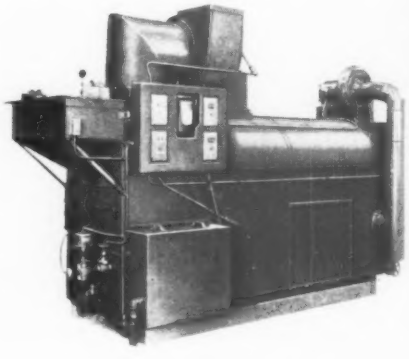
Specially tooled Thomson welding press attaches metal handles to boxes.

Spot-Welding Press

★ The Thomson No. 1 welding press is readily adapted to special production operations such as the one illustrated. In this case the lower knee and upper terminal block are designed to attach handle cleats to a metal box cover. Locating fixtures make it easy to line up the box covers. The lower die is faced with a conductive alloy, and the upper die is equipped with eight individually sprung electrodes and with a fixture to locate the handle cleats. The welder is motor operated and has a solenoid clutch pull and electronic timing. The welding speed may be varied between 34 and 109 strokes per minute. **Thomson-Gibb Electric Welding Co.**, Lynn, Mass.

Rinsing and Drying Machine

★ A new machine for the rinsing and drying of screw-machine or small stamped parts has been announced by **Optimus Equipment Co.**, 249 Church St., Matawan, N. J. This is a screw drum-type machine, versatile in its applications. It can be used for washing and drying, rinsing and drying or any part of these operations. It is also adaptable to a wash-drain, rinse-drain, cold- or hot-air-dry operation sequence.



"Optimus" screw-drum-type rinsing and drying machine.

POROSITY FREE WELDS ON BRONZE WITH CUPRO-ARC ELECTRODES

EASY SLAG REMOVAL

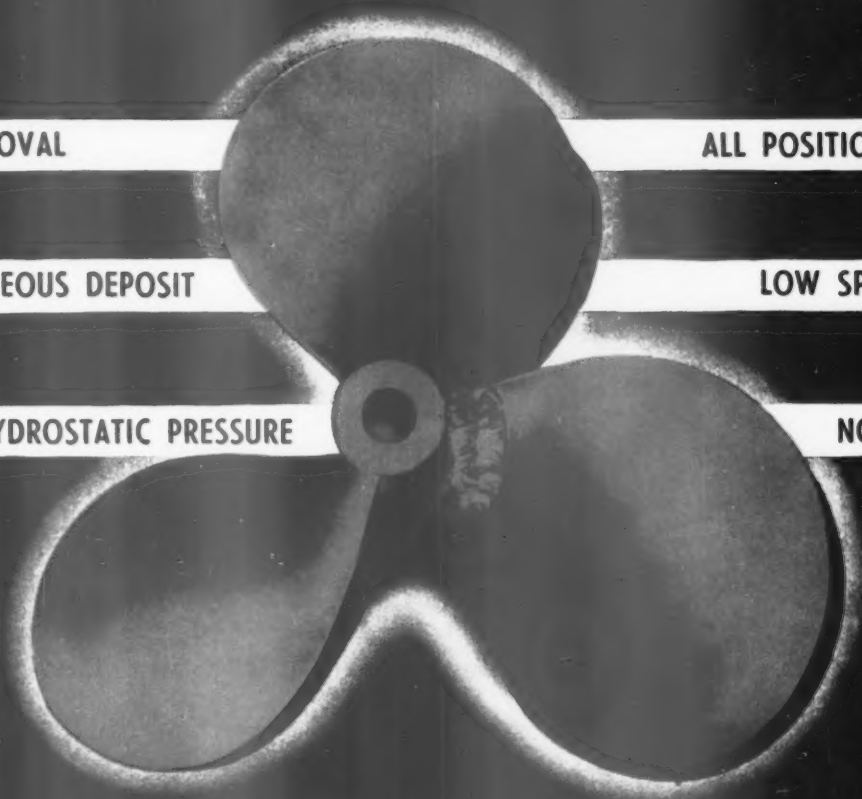
ALL POSITION WELDING

SOFT HOMOGENEOUS DEPOSIT

LOW SPATTER LOSS

WITHSTANDS HYDROSTATIC PRESSURE

NO POROSITY



CUPRO-ARC "C" – A NEW PHOSPHOR BRONZE ELECTRODE FOR ALL POSITION WELDING OF BRASS, BRONZE, COPPER, CAST IRON AND STEEL.

The manufacturers of the famous line of Arcaloy Stainless Steel, Tool-Arc Tool Steel and Nickel-Arc electrodes have introduced to the Bronze welding field an entirely new heavily coated extruded electrode—Cupro-Arc "C".

In addition to the superior characteristics listed above, Cupro-Arc produces a smooth flowing arc which eliminates the erratic arc action previously characterized by Bronze electrodes. Cupro-Arc is designed especially for use in the downhand, vertical or overhead positions with reverse polarity D.C. current. Prove it by trial with Cupro-Arc.

Obtain full information from your local Alloy Rods Co. distributor, or write York, Penna. for bulletin CAC-1145.

Alloy Rods Co.

YORK, PA.

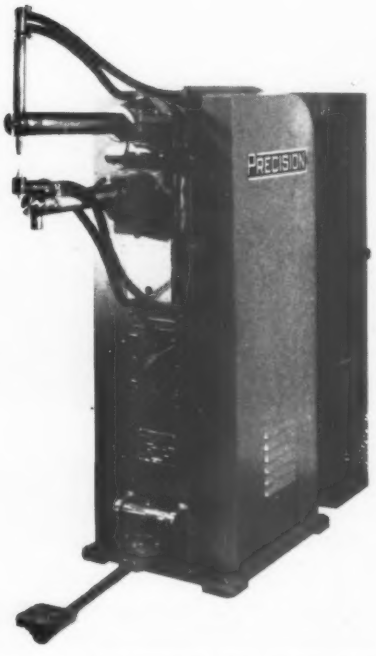
Pneumatic Hammer

★ Previously sold almost exclusively to war production plants, the "Bantam Bully" air hammer is now available for peacetime production jobs. Its uses include all kinds of cold chiseling, peening, stripping off welding flash, light scaling, light riveting, paint and rust removal, template marking, loosening stubborn threaded fastenings by vibration, etc.

The "Bantam Bully" is a small, powerful pneumatic hammer delivering some 13,000 blows per minute and operating on less than 2 cu ft of air at 80 to 100 psi. It weighs less than 2 lb and has an aluminum pistol-grip handle fitting easily into the hand. The valve control is in the pistol trigger position. Tools, of which a wide variety are available, are loaded in a ball-and-channel locking chuck. A quarter turn of the knurled nose of the chuck will lock or release the tool. **Superior Mfg. Co.**, Public Square Bldg., Cleveland 13.

"Bantam Bully" air hammer. Its only moving part is the piston striking member.

» «



Precision foot-operated spot welder gives 400 lb welding pressure when the operator exerts a 50 lb pressure on the treadle.

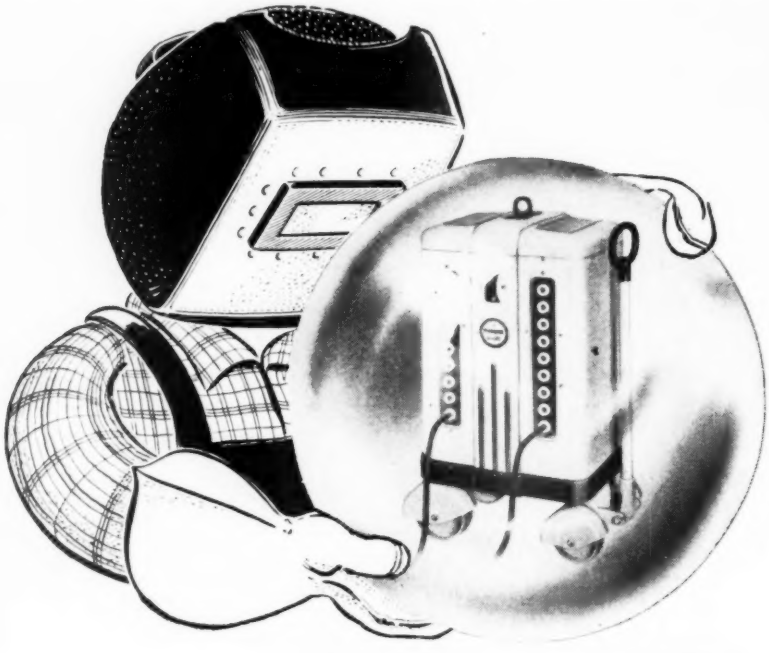
Foot-Operated Spot Welder

★ A rocker-arm, foot-operated spot welder has been especially designed by Precision Welder and Machine Co. to overcome the major objection to foot operation—lack of pressure. This is done by a mechanism providing welding pressures up to 400 lb on the electrodes when a pressure of 50 lb is exerted by the operator. A foot-treadle movement of 2½ in. gives 1¼ in. electrode movement (adjustable for best operating condition). Other features are: removable side covers; sides of machine kept clear for material handling and storage; new design of transformer mounting; timer and contactor mounted at rear; microswitch firing of timer to insure pressure before flow of weld current; a fabricated frame of rigid channel construction. **Precision Welder and Machine Co.**, English and Neave Sts., Cincinnati 4.

« »

Electronic Interval Timer

★ An electronic timer for photo or interval timing has been developed to provide accurate interval control from 1/25 second to 80 seconds. The timer employs two electronic tubes, is easy to set and is foolproof. Once set for a given interval, it will repeat that exact time cycle whenever its push button is operated. Whether the operator keeps his finger on the push button or takes it off before the time cycle is complete does not affect the cycle once it has been initiated. **Caltron Co.**, 11744 West Pico Blvd., Los Angeles 34.



Your FUTURE will be Brighter

WITH MARQUETTE REGISTERED U.S. PAT. OFFICE A.C. ARC WELDERS

Marquette A. C. Arc Welders take all production and maintenance welding jobs in stride. Welded construction is the modern shortcut to faster production. It eliminates unnecessary flanges, excess metal, drilling, tapping, riveting and provides a stronger finished product. The unbeatable combination of Marquette A. C. Arc Welders and Marquette Electrodes enables you to do economical, high-speed welding on all sizes and types of metal . . . the answer to low cost production problems. Your future depends upon how you meet competition. Be prepared by ordering a Marquette A. C. Arc Welder from one of the 700 Marquette Distributors who are ready to serve you.

Send for Free 24 page illustrated booklet

MARQUETTE MFG. CO., INC.
Minneapolis 14, Minnesota

MARQUETTE REGISTERED U.S. PAT. OFFICE Welding EQUIPMENT ELECTRODES And SUPPLIES

3 new features

"More Arc Time with" MARTIN WELLS' *Rod Saver* ELECTRODE HOLDER

1. New "Mitt-grip" sleeve. Ribbed construction assures positive grip, eliminates slipping in glove or mitt when changing rods.

2. Higher amp. capacity. New one-piece combination terminal and bushing, made of high conductivity copper alloy, increases amperage capacity. It will operate under sustained welding conditions on 5/16" electrodes at 400 to 500 amps.

3. Holders available with either 60° or 90° angle rod position hole. Option gives weldor greater flexibility, makes close quarter work easier.

Above:
MODEL 4H
400-500 amps
19 ounces

"More Arc Time"
Martin Wells
ELECTRODE HOLDERS
Los Angeles 1, California

AIR REDUCTION—NATIONAL DISTRIBUTORS

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CEDAR RAPIDS—L. B. Lamb Sales Co.
CHICAGO—Steel Sales Corp.
CINCINNATI—Williams & Co. Inc.
CLEVELAND—Williams & Co. Inc.
COLUMBUS—Williams & Co. Inc.
MILWAUKEE—Steel Sales Corp.
DETROIT—Steel Sales Corp.
HOUSTON and throughout TEXAS—Weldit Acetylene Co.
HONOLULU—Magnolia Airco Gas Products Co.
MINNEAPOLIS—Hawaiian Gas Products, Ltd.
MONTREAL—Steel Sales Corp.
NEW YORK—Rudel Machinery Co.
VANCOUVER, B.C.—Chicago Combustion Co.
OMAHA—Scott Foster & Co.
PHOENIX—The Balbach Company
PITTSBURGH—Fuchs Machinery & Supply Co.
SAGINAW—Arizona Welding Equipment
ST. LOUIS—Williams & Co. Inc.
SAN FRANCISCO—Northern Supply Co.
SPOKANE—Steel Sales Corp.
Pitts & Loughlin
Gibson Welding Supply Co.

AWS Annual Meeting

THE 26th annual meeting of the American Welding Society was held at the Hotel Pennsylvania, New York City, October 18. Due to wartime restrictions on convention activities, the meeting was confined to the awarding of medals and prizes, the Adams lecture and a business session.

In opening the general session, E. V. David, chairman of the convention committee, delivered an address of welcome to the over 300 local and out-of-town guests present. The 1944 recipient of the Samuel Wylie Miller award, for his conspicuous contributions made to the advancement of the welding and cutting of metals, was J. H. Deppeler, chief engineer, Metal and Thermit Corp., New York City. Dr. H. C. Boardman made the presentation. Mr. Deppeler was the second president of the American Welding Society.

Leon C. Bibber, welding engineer, Carnegie-Illinois Steel Corp., received this year's award of the Lincoln Gold Medal and Certificate, given by J. F. Lincoln, president, The Lincoln Electric Co., to the author or authors of the paper judged to represent the greatest original contribution to the advancement and use of welding.

Resistance-Welding Awards

Charles Eisler, president, Resistance Welder Manufacturers Association, presented the annual RWMA awards as follows:

$500 prize for the best paper emanating from an industrial source to L. A. McIntosh for his paper on "Resistance Welding for Economy and Quality."

$200 prize for the best paper emanating from a university source to W. F. Hess, R. A. Wyant and B. L. Averbach for their paper on "The Surface Treatment at Room Temperature of Aluminum Alloys for Spot Welding."

$200 prize for the best paper emanating from an industrial source to G. W. Scott, Jr., L. G. Sutton and J. H. Widmyer for their paper entitled "Radiography for Development and Control of Aluminum Alloy Spot Welding."

$100 prize to J. C. Barrett for his paper on "Flash Welding of Alloy Steels — Physical and Metallurgical Characteristics."

Honorary AWS memberships were awarded to three past presidents: Dr. David S. Jacobus, J. H. Deppeler and Dr. Harry C. Boardman.

The third annual Comfort A. Adams Lecture entitled "Selection of Steels for Welding" was presented by Dr. Samuel L. Hoyt, technical advisor, Battelle Memorial Institute, Columbus, O. The Adams lecture is given annually by a man who is outstanding for attainments in the science and art of welding and is named in honor of the first AWS president.

Dr. Hoyt's paper, dealing with the selection of steel for welding, pointed out the significance of an almost completely ignored property of steel, its cohesive strength. Metal scientists have been studying cohesive strength in their laboratories for years, and the lecture was a plea for the application of their findings to steel manufacture and to the design and fabrication of welded structures.

Dr. W. F. Hess, 1945-46 AWS president, has been selected by the Award Committee as the 1946 Adams lecturer.

The annual business meeting of the society, held in the afternoon, was confined to reports by the secretary, treasurer, chairman of the Technical Activities Committee and chairman of the Welding Research Council. Miss M. M. Kelly, the society's secretary, reported that the society was 26 years old and has over 8,000 members. The membership gain during the past year was over 28%, offset by a loss of 20%, due mostly to occupational changes, deaths and the like, making a net gain for the year of 8%.

During the past year, new AWS sections have been organized at Hartford, Conn., South Bend (Michiana), Ind., Erie (northwestern Pennsylvania), Pa., and Tacoma, Wash.

1945 Revised Standards

"Tentative Specifications for Iron and Steel Arc-Welding Electrodes, A233-45T." This revision also includes the "Guide to the Classification of Iron and Steel Arc-Welding Electrodes," prepared to assist potential users of these electrodes in determining the classification of electrodes best suited for their needs.

"Code of Minimum Requirements for Instruction of Welding Operators: Part A—Arc Welding of Steel $\frac{3}{16}$ to $\frac{3}{4}$ in. Thick." This standard has been revised and elevated to the status of a full AWS standard.

The following standards are presently receiving consideration of the technical committees and are expected to be available before the close of the present year:

"Tentative Specifications for Gas-Welding Rods for Wrought Aluminum and Aluminum Alloys."

W. F. HESS
Newly installed president, AWS

"Tentative Recommended Practices for Resistance Welding." This standard will comprise a group of recommended practices covering the spot and seam welding of low-carbon, stainless and low-alloy steels and nickel and nickel alloys; projection welding of low-carbon and stainless steels; flash welding of medium forging strength steels; methods of testing resistance welds.

The Emergency Standard "Inspection Handbook for Manual Metal Arc-Welding," prepared in 1944 and submitted to the U. S. Army Ordnance Department for publication and distribution among its personnel, is to be issued shortly by AWS.

New Officers

The new officers installed are:

President: Dr. Wendell F. Hess, professor of Metallurgical Engineering and head of Welding Research Laboratory, Rensselaer Polytechnic Institute, Troy, N. Y.

First vice-president: Harold O. Hill, assistant chief engineer, fabricated steel construction, Bethlehem Steel Co., Bethlehem, Pa.

Second vice-president: George N. Sieger, president and general manager, S-M-S Corp., Detroit.

The social activities of the 26th annual meeting were combined with the 25th anniversary dinner of the New York Section. Following the dinner the guest speaker, Dr. John R. Dunning, director of a division of war research, Columbia University, and also associated with the Kellex Corp., builders of one of the atomic-bomb plants at Oak Ridge, Tenn., discussed "Atomic Energy." Many interesting sidelights on welding were given in this "off-the-record" talk.

Preferred by the "Man on the Job"!

OTHER McKAY MILD STEEL ELECTRODES	
McKay Grade	A.W.S. No.
No. 21	E4510
No. 3	E4520
No. 15	E6010
No. 17	E6012
No. 116	E6012
No. 16	E6020
No. 18	E6030
No. 16-H	None
No. 117	None
No. 19	None
No. 10	None
No. 715	E7010
No. 711	E7011
No. 713	None
No. 716	E7020

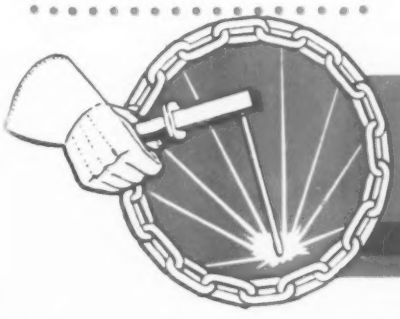
Because McKAY No. 14 is the *one* electrode which meets most welding rod requirements for maintenance, repair and operating—it has been popularly called the MRO Electrode by the man on the job.

The McKAY No. 14 Electrode is particularly suitable for factory maintenance. It operates with equal ease on either AC or DC machines. Even a relatively inexperienced welder does not have difficulty in getting excellent results.

But whether you require this mild steel electrode or any other of the wide range of mild steel, alloy steel and stainless steel electrodes—specify McKAY by name. The complete uniformity and successful performance of McKAY Rods under all work-uses make McKAY Welding Electrodes preferred by the "man on the job" as well as by the men who engineer the jobs.

Specifications:

McKAY No. 14 Mild Steel Electrode—Made to conform to the standards of American Welding Society's E6020 type of electrode. Made in sizes 1/16", 5/64", 3/32", 1/8", 5/32", 3/16", 7/32", 1/4" and 5/16".



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THE McKAY COMPANY
PITTSBURGH, PA.

WELDING ELECTRODES . . . COMMERCIAL CHAINS . . . TIRE CHAINS

News of the Industry

Chicago AWS Section Celebrates Anniversary

Over 400 members and guests of the Chicago section of the American Welding Society celebrated the section's 25th anniversary on Oct. 11 with a dinner-dance in the Grand Ball Room of the Stevens Hotel, Chicago. Many oldtimers were on hand, some of whom had to travel long distances for the event. C. J. McGregor acted as toastmaster, and Clyde G. Bassler, president of the section, gave the address of welcome. Honored guests were then introduced, including L. B. Osburn, vice-president of the Pullman Co., and the section's first chairman.

A feature of the evening was the presentation of a silver pitcher to Mrs. G. H. Mackenzie, publisher of THE WELDING ENGINEER, in part as a tribute to her husband, the late L. B. Mackenzie, and in part in recognition of her own important contributions to the advancement of the Chicago section and of welding generally. Mr. Mackenzie, who founded THE WELDING ENGINEER in January, 1916, and served as its first editor, was also one of the founders of the Chicago chapter of AWS in 1920. The Chicago charter was the second to be granted by the national organization and it was received within a short time after the first charter had been granted to Philadelphia.

The formal part of the evening closed with the entertaining talk and demonstrations, "Adventures in Research," by Dr. Phillips Thomas of Westinghouse Electric Corp.

Metal Show to Be Held at Cleveland, Feb. 4-8

The postponed 27th National Metal Exposition will be held in Cleveland's big Public Auditorium from Monday, February 4 through Friday, February 8, 1946, according to an announcement last month by W. H. Eisenman, managing director of the Exposition and national secretary of the American Society for Metals, sponsor of the event. This show had originally been scheduled for October, 1945.

"This industrial show will be the largest ever held in America," Mr. Eisenman predicted. "Manufacturers are ready for reconversion and eager for the opportunity to show the new machines, materials and processes that have been developed in war and to demonstrate their peacetime possibilities."

Coöperating with the American Society for Metals in presenting the Metal Show will be the American Welding Society, the Iron and Steel and Institute of Metals divisions of the American Institute of Mining and Metallurgical Engineers, and the American Industrial Radium and X-Ray Society.

The extent to which the American Welding Society would participate had not yet been decided when this issue of THE WELDING ENGINEER went to press.

Longer Ultraviolet Rays Also Affect Weldors' Eyes

Experiments with baby chicks reveal that exposure of eyes to invisible ultraviolet light ranging from 300 to 365 millimicrons in wave length—a range previously considered harmless by some authorities—delays dark adaptation and impairs visual functions even when the eyes themselves show no obvious injury.

Dr. Ernst Wolf, of the Harvard Biological Laboratories, reported the discovery in the August issue of the *Proceedings of the National Academy of Sciences*. The eye research was sponsored by American Optical Co., Southbridge, Mass.

As human eyes could not be utilized in view of the potential danger, Dr. Wolf selected baby chicks for testing because the visual characteristics of their eyes approximate closely those of a human being and also because chicks obligingly keep their eyes wide open during exposure to ultraviolet. After a year's study of the effect, he discovered that the ultraviolet light in question definitely impaired the functioning of the chicks' visual mechanism (see the two pictures reproduced herewith). He concluded, therefore, that protective lenses capable of excluding the dangerous rays should be worn by weldors and their helpers as well as by skiers, fliers, sun bathers, etc.

Previously, some authorities had assumed that if ultraviolet below 300 millimicrons were excluded by filter lenses the possibilities of eye injuries would be eliminated. The welding arc emits ultraviolet ranging from 190 millimicrons to the visible portion of the electromagnetic spectrum.

Welding Distributors Form New National Association

The National Welding Supply Association, an association composed of wholesale welding equipment distributors, was organized recently at Dayton, O. Membership is composed of both active and associate members.

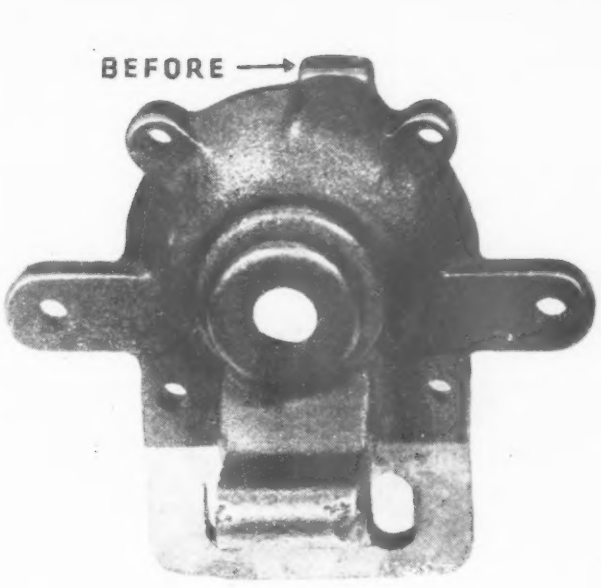
The object of the association is given as: "to promote and maintain such constructive coöperation among distributors of welding equipment as will advance their mutual interests; inspire the observance of high business standards; stimulate the adoption of such business methods as will make for efficient and profitable operation; encourage adherence to sound sales policies and practices; correct faulty procedures and eliminate commercial evils; all to the end that the wholesale welding supply business may retain its place and identity as an essential and efficient service in the distribution of welding equipment, supplies and gases."

Association headquarters are located at 324 E. Second St., Dayton 2. Distributors of welding equipment, gases and supplies are invited to write for membership application forms. Inquiries are also invited from manufacturers.

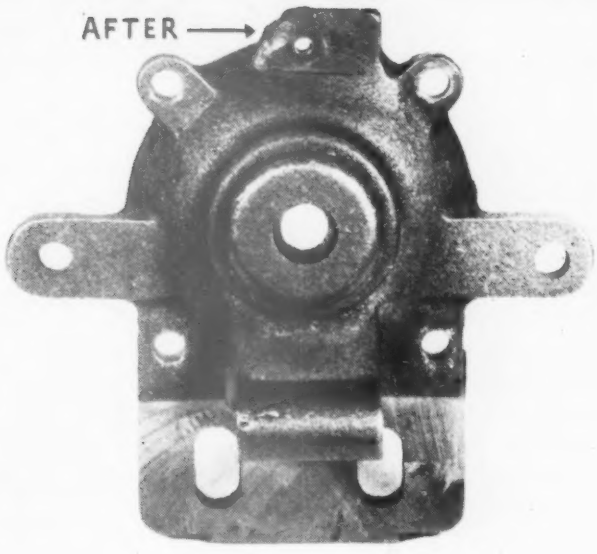
Foote Mineral Moves Office

Foote Mineral Co., Philadelphia, processor of metals, alloys, ores and chemicals, announces the removal of its entire offices to 12 East Chelten Ave., Philadelphia 44.

Left: Close-up of a normal healthy chick's eye which has not been exposed to ultraviolet. Right: Close-up of a chick's eye 24 hours after exposure to dangerous ultraviolet for 60 minutes. The eye shows pronounced injury by swollen eyelids, blood infiltration of the conjunctiva and cloudiness of the cornea, which in the normal eye is highly transparent.



After several hundred of these cast iron end plates had been fully machined, a design change was made which required more metal on the lug at the top, to accommodate a drilled and tapped hole.



The size of the lug on each plate was easily increased by depositing just a small amount of PHILLIPS "600" on one side. Only 40 seconds welding time on each piece. Hole was then drilled and tapped directly through the line of fusion.

When design changes are necessary

Protect your investment in machining time by arc welding with

PHILLIPS "600" Electrode

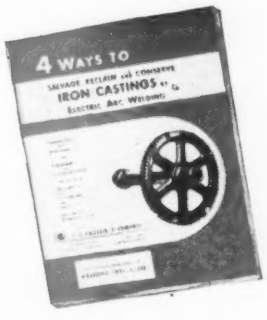
This situation will occur frequently during reconversion: Hundreds of small gray iron castings made and finish machined, waiting for delivery — then an engineering change is made that calls for metal where there isn't any metal.

Even though scrapping of castings means only a small material loss, the investment in machining time is not to be thrown away lightly. Therefore, when these situations arise it pays to have a stock of PHILLIPS "600" Electrode on hand, and to know how to use it.

Note these facts concerning PHILLIPS "600" Electrode: It cuts costs by salvaging defective castings, building up worn castings and accommodating design changes. Deposits of PHILLIPS "600" are of the same color as cast iron, and they are fully machinable, even through the line of fusion. This electrode is not new or experimental—it has been in successful use for years.

Procedure details are explained in our "4-Ways" book, shown at the right. Our nearest distributor will be glad to send a representative to discuss applications in your shop or plant.

THIS BOOK TELLS HOW



Our "4-Ways" manual is a complete guide to the selection of materials and procedures for arc welding cast iron. Send for your copy TODAY.

C. C. PHILLIPS & COMPANY

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Detroit 8, Michigan

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MANUFACTURERS AND DISTRIBUTORS OF WELDING ELECTRODES AND SPECIALTIES

"459" Is Important in the List of *Conservation Welding* Materials

Amsco 459 Hard-Surfacing Welding Rod is highly effective for hard-surfacing parts which are subject to severe abrasion and moderate impact. This cast rod of high chromium, molybdenum and carbon content provides sound deposits with a Brinell hardness of 500-600 and an abrasion resistance which makes its use highly practical even where abrasion resistant steels are used for wearing parts. Where ordinary mild steels are employed for punished parts the application of No. 459 is an economic necessity.

Application of Amsco 459 has given a much longer useful life to such parts as plow shares, dipper teeth, rolling mill guides, drag chain, coal cutter bits, pump shells and impellers operating in sand, pug mills, muller and mixer parts, scarifier teeth, cement block tampers, scraper blades, shredder knives and many other parts that are subjected to the abrasion of loose gritty materials or friction from contact with other metals.

This hard-surfacing rod saves large sums annually for construction firms, mine and quarry operators, cement mills, steel mills, clay products plants, highway departments, farmers and general industry. A typical application is pictured (C-337B). Here, a 7 ft. cement clinker grinding ring with an 8" face for a Hercules mill which, after being coated on inside and sides with 459, gave 4,442 hours service at a cost of 12.45 cents per hour. We have numerous similar case studies in our files. The labor and material cost involved in applying 459 is more than justified by the savings that result.

Bulletin W-20A simplifies the use of 459 Rod, and Bulletin 941-W covers all Amsco Conservation Welding Products.

Amsco Welding Products in Canada are manufactured and sold by Canadian Ramapo Iron Works, Ltd., Niagara Falls, Ontario.

Amsco
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Illinois

AMERICAN Brake Shoe COMPANY

FOUNDRIES AT CHICAGO HEIGHTS, ILL., NEW CASTLE, DEL., DENVER, COLO., OAKLAND, CALIF., LOS ANGELES, CALIF., ST. LOUIS, MO.
OFFICES IN PRINCIPAL CITIES

Vets Must Be Given Their Old Jobs, Says Selective Service

Certain controversial questions with regard to veterans' reemployment rights under Section 8 of the Selective Service Act have made it necessary to render interpretations of these statutory rights for the guidance of local boards. Below are some of the highlights of the comprehensive statement of policy governing the Selective Service Veterans Assistance Program. A copy of the complete handbook of the Veterans Assistance Program is available upon request to Selective Service National Headquarters, 21st and C Sts., N. W., Washington 25, D. C.

The law provides that if a veteran left a position other than temporary to enter military service, has satisfactorily completed that service, is still qualified to perform the duties of his former civilian position, and makes application for reinstatement within 90 days after severance from the military establishment, he has absolute right to reinstatement, unless it is proved to be impossible or unreasonable for the employer to reinstate him.

The present law provides absolute reinstatement in the veteran's former position, or in a position of like seniority, status and pay, if the veteran meets the statutory requirements. A broad interpretation is given to the much discussed question involving the "temporary" or "other than temporary" nature of the job which the veteran left to enter military service.

"Before a veteran is deprived of reemployment rights, it must be shown clearly that the employment he left to enter the armed services was 'temporary,'" the statement said. "In border-line cases, the question as to whether the veteran's position was or was not temporary should be resolved in favor of the veteran."

The fact that several veterans left the same job assignment in an employer's establishment to enter the armed forces is not determinative of whether the position was temporary or other than temporary, the statement continues. It is the character of the employment relationship that should govern and not merely the particular assignment being carried out at the time of entry into active military service.

Work performed on a part-time rather than a full-time basis does not necessarily render a position a temporary one, the Selective Service opinion asserts. Neither can the question be determined by use of such terms as "probationary," "apprentice" and "trainee." In each case, consideration must be given to the character of the employment relationship and all of the facts and circumstances surrounding it.

The Selective Service Act provides that the veteran must be reinstated unless the employer's circumstances have so changed as to make it "impossible or unreasonable for the employer to do so. The contention has been advanced that reinstatement of a veteran would be "impossible or unreasonable" if his reemployment displaced a non-veteran with greater seniority. The Selective Service interpretation meets this issue with the statement that the "impossible or unreasonable" clause applies only to the employer and that consequences to third parties are not involved.

A Small Advertisement...

BUT *what an* IMPORTANT *Message!*

Does the Torch You Use Have these "MODERN Advantages?"

Uses Diversified Tips—sizes 00 to 12. One piece "Goose Neck" and solid screw-in types, both producing fine point flames.

The famous Circle Mixer handles all sizes of Tips—actually mixes the gases together without necessitating change in orfice sizes. Provides for a longer, hotter flame with low gas pressures and consumption. (Pat. No. 1,996,991)

Spring Tension Needle Valve assures "fixed" position under all operating conditions. (Pat. No. 2,026,028)

—and You Can Repair ANY Operating Part Yourself — Right on the Job!

Modern engineers designed all MECO Torches for the convenience and economy of Operators; each being 'balanced' to handle perfectly. Light weight forged handle. Among other patented MODERN advantages are the Gasket Type Joint which simplifies repairs and insures tight joints, and the easily detachable Retaining Ring. All these advantages and more are provided in MECO Torches.

What Equipment are YOU Using Now?

MODERN ENGINEERING COMPANY, Inc.

3401-15 PINE BLVD. ST. LOUIS 3, MISSOURI

...Read it Carefully

EENY, MEENIE, MINEY, MOE!

...MAY BE ONE WAY OF SELECTING WELDING EQUIPMENT,

BUT...

THE CHOICE OF

DUALARC

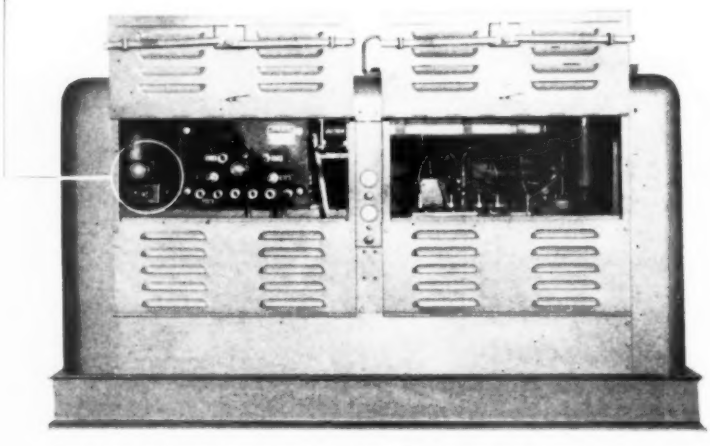
GIVES YOU ASSURANCE OF THE BEST!

SELF-CONTAINED Compact, powered by gasoline or Diesel engine; stationary and portable.

EASY TO OPERATE DUALARC'S exclusive Shunt Inductor feature assures smooth arc performance and minimizes arc start shock on engine and generator.

VERSATILE Complete power takeoff, both electrical and mechanical. 110V AC Auxiliary, 1 to 3 KW, for lights, drills, grinders, etc. Drive shaft for all equipment operating within its power range.

AC Auxiliary 110V or 220V 3 KW. Equipped with Dualarc's Exclusive Feature, which furnishes AC auxiliary power for portable equipment.



Model SK-300 "Dualarc" Welder. Welding Range 35 to 375 Amps—DC. Stationary Model.

All "Dualarcs" equipped with Electric Self-Starters
All Models Totally Enclosed
All Models can be powered either by Gasoline or Diesel Engines

ELECTRIC ARC, Inc.

152-162 Jelliff Ave. **Newark 8, New Jersey**

Manufacturers of

Arc Welders — Electrical Heat Treating Equipment — Power Units — A. C. Welders

Organize Group to Fight Patent Foes

Plans for a counteroffensive against widely publicized attacks on the U. S. patent system are being made by a nation-wide group of smaller manufacturers, representing 28 classes of industries, according to an announcement by John W. Anderson, president, The Anderson Co., Gary, Ind., leader of the movement. The new organization, incorporated as National Patent Council, will be controlled by smaller manufacturers. Headquarters will be at Gary, but offices will be opened in New York and on the Pacific Coast.

"Although the vociferous critics of the patent system profess to be saving the country from monopoly, they are in reality promoting monopoly by threatening the life of every smaller company relying upon patents," said Mr. Anderson. "Smaller manufacturers, who employ most American factory workers, also originate and produce most of the patented inventions upon which industry is based."

Some 200 leading patent lawyers have already volunteered their services on technical patent matters as advisory associates of the council.

» «

Research Corp. Offers $2,500,000 for Postwar Collegiate Research

Scientists who made the atomic bomb, radar and a host of other vital war weapons will have a chance to return promptly to college laboratories for scientific research and teaching through $2,500,000 in grants being offered to educational institutions by Research Corp., 405 Lexington Ave., New York City 17. This is a non-profit organization devoted to advancing research and technology by use of revenues from inventions assigned to it by public-spirited inventors.

The five-year program was announced by Dr. Joseph M. Barker, acting president, who has returned to his duties with the corporation and as dean of engineering with Columbia University from service as special assistant to the Secretary of the Navy. Dr. Barker said that 100 to 200 grants of $2,500 to $5,000 will be made each year in order that talented young scientists will be able to undertake peace-time research in pure science, especially in chemistry, physics, mathematics and engineering.

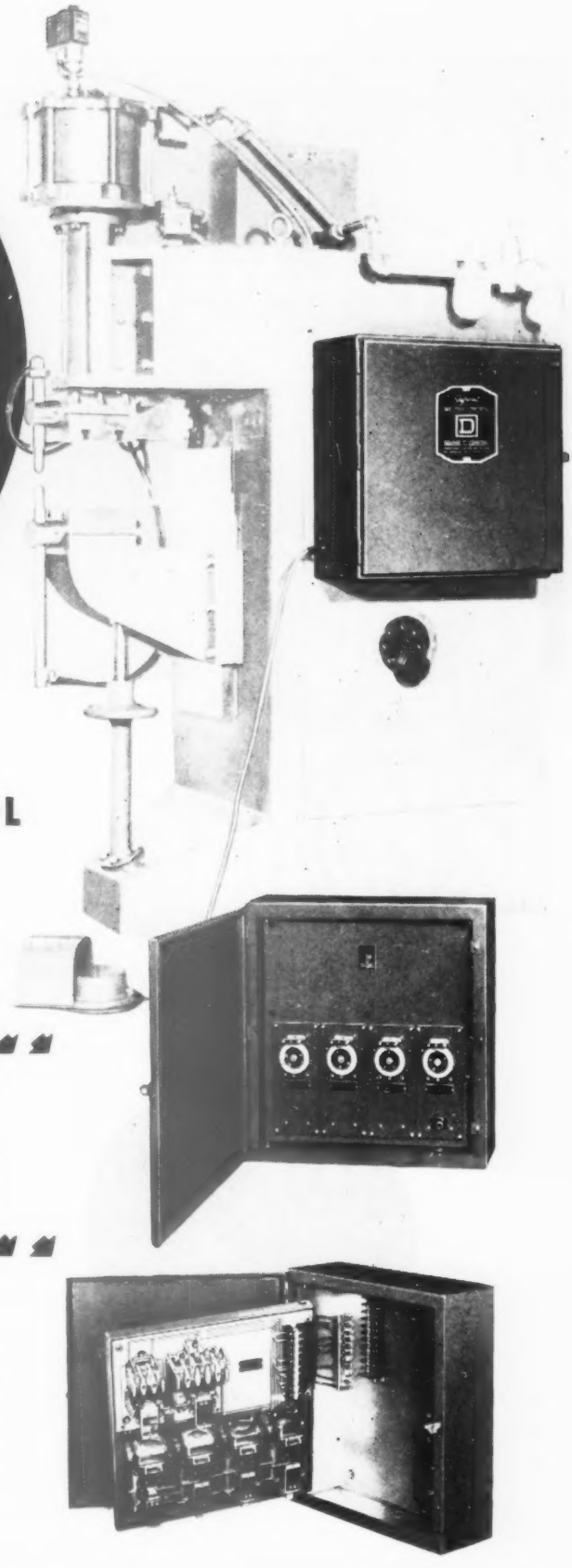
» «

Westinghouse Purchases Meadville, Pa., Plant

Westinghouse Electric Corp., Pittsburgh, has announced the purchase of property and buildings in Meadville, Pa., for the production of industrial heating equipment. The property, comprising more than five acres of land and five major buildings with more than 100,000 square feet of floor space, is being purchased from Talon, Inc.

"The entire Westinghouse line of industrial heating equipment will be produced in the Meadville plant," said L. B. McCully, manager of the Westinghouse transportation and generator division. This includes many types of furnaces and other devices for heat-treating, driers, immersion heaters, space heaters and thermostats."

SIMPLICITY *and* ACCESSIBILITY



Outstanding Features of *Safront* WELDER CONTROL

SIMPLICITY! Only simple magnetic relays and pneumatic timing units are used in the assembly of Safront Weld and Sequence Timers. Circuits are conventional —easy for the electrician to understand and service. Individual pneumatic timing relays govern each step in the resistance welding cycle. Operation is based on the interval required to transfer a small volume of filtered air from one chamber to another, through a regulated orifice.

ACCESSIBILITY! Loosening two screws permits swing-out of the Safront timer panel. Control relays, timing relays, terminals and wiring are instantly accessible for inspection or maintenance. Coils, contacts and all renewable parts may be replaced, in a matter of seconds, using only a screwdriver and pliers.

* * *

Standard types of Safront timers are available to meet practically all resistance welding requirements. Safront construction places all electrically "live" parts behind a protective panel, yet provides large calibrated dials with knurled adjusting wheels in front, for finger-tip adjustment of individual timing periods.

Write for Bulletin 8991. Address Industrial Controller Division, 4041 N. Richards St., Milwaukee 12, Wis.

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

Martin Co. to "Can" Surplus War Goods

Valuable war surplus materials, running all the way from heavy machine tools to delicate instruments and electrical apparatus, are to be "canned" in aluminum as one of the peacetime projects of the Glenn L. Martin Co., Baltimore. By eliminating the necessity for warehousing, this development solved one of the great problems confronting those interested in the storage of surplus war materials since it permits the storage of "canned materials" in the open.

Ingenious aluminum "barriers," some of which "breathe" through a drying agent and others of which are hermetically sealed, have been developed as the result of experimental contracts with Army Ordnance for the canning of guns. It has been determined that by such methods all sorts of manufactured articles and materials can be stored in the open for many years without rust, corrosion or deterioration.

In announcing the postwar project, which conceivably can run into big business and occupy all of the surplus plant space of the airplane company, Glenn L. Martin, president of the company, declared that billions of dollars worth of equipment made during the war could be saved for a future market.

» «

New Factory Building

The American Welding and Engineering Corp., Milwaukee, has filed an applica[tion] with the city building inspector for a $50,000 factory building on West Oklaho[ma] Avenue, near Chase. The one-story st[eel] structure, 80 by 120 feet, will include t[wo] large bays. An office building will [be] erected later on the same tract of la[nd]. The company, headed by Max F. Reinho[ld], will continue to use its present proper[ty] at 820 South Water St. even after the ne[w] building is occupied.

» «

United Tube of Ohio Opens New Plant for Welded Tubing

The United Tube Corp. of Ohio, manufacturer of welded mechanical tubing, announces the opening of a new plant at 2134 West 53rd St., Cleveland. Production of mechanical steel and alloy irrigation tubing, in sizes of ⅜ to 6½ in., is already under way. With this new plant, United Tube of Ohio is now in an advantageous position to supply cold-drawn, butt-weld and welded tubing to meet any practical commercial need. The Ohio tube concern is associated with the United Tube Corp. of Pennsylvania and Ellwood Products Corp., both of Ellwood City, Pa.

» «

Ford Buys Site for New Jersey Plant

Ford Motor Co. last month purchased 78 acres of land in New Jersey, 30 miles southwest of Manhattan, as a site for construction of a new plant to assemble Mercury and Lincoln automobiles. The new plant, to be known as the Raritan plant, will be capable of producing 350 cars a day and will be the first plant to build Lincolns outside the Detroit area. Construction of the 500,000 sq ft building is expected to start early next spring.

New Distributors

Mir-O-Col Alloy Co., Los Angeles: Westland Equipment Co., 660 N. Tillamook St., Portland 12; Bud's Welding Supply & Repair Service, 944 Market St., Tacoma 3; Fisher Brothers Co., 525 Bond St., Astoria, Ore.; Parrot & Hahn, Inc., 309 W. 4th Ave., Olympia, Wash; Sacramento Welding Supply Co., 1214 Seventeenth St., Sacramento; Cornelius Supply Co., Dumas, Texas; Gas Arc Supply Co., 1616 Avenue H, Lubbock, Texas; New Mexico Welding Supply Co., 208 Mitchell St., Clovis, N. M.; Auto Parts & Tool Co., 108 N. Henry St., Bay City, Mich.; Whitehead Metal Products Co., Inc., New York City, Philadelphia, Baltimore, Buffalo, Syracuse, Newark and Boston.

» «

The Resisto-Loy Co., Grand Rapids, Mich: S. S. Callner & Co., 53 W. Jackson Blvd., Chicago 4, as sales representative for the Chicago area; The Turney & Beale Co., Bayside, Long Island, N. Y., as sales representative for eastern New York state and the New England states; John C. Thiem, College Park, Ga., as representative for the states of Florida, Georgia, North and South Carolina, Alabama, Mississippi and Louisiana.

SAVE TIME USE A
CMD
WELDERS CHIPPING HAMMER
With steel or wooden handle. Light weight. Strong. Easy to use. Write for circular.
TYPES EB and FB
Models E and F can be supplied with brush as shown here. Brush can be replaced by unscrewing countersunk screw in bracket and removing.
TYPE F
Head has two chisels at right angles.
TYPE E
Head has drift and chisel.
TYPE A
Has drift and chisel. Widely used in malleable and grey iron foundries for general chipping.
TYPE CB
Combines 3 tools in 1—drift, chisel and removable wire brush.
TYPE C
Same as Type CB, but without brush.
CHICAGO MANUFACTURING AND DISTRIBUTING COMPANY
1928 WEST 46th ST., DEPT. W., CHICAGO 9, ILLINOIS

Carbon Arc Welding of Brass

...reduces warpage
...saves man-hours

GOOD EXAMPLES *of limited warpage with carbon arc welding. Had gas welding been used, the flanges might be wavy, and the tank metal buckled on this distillation condenser made of Naval Brass.*

Distillation condenser fabricated of Naval Brass by the Carbon Arc Method of welding. Developed by Chase, this new technique saves man-hours and holds warpage to a minimum.

In gas welding of brass, there's always the danger of warpage. To hold warpage to a minimum in fabricating this distillation condenser of Naval Brass, S. D. Hicks Engineering Company of Boston relied upon a carbon arc method of welding brass developed by engineers of Chase Brass & Copper Co.

With this new technique of carbon arc welding, man-hours are saved (because of less heat dissipation into the base metal) and costs are cut (because the work goes faster), in addition to the fact that *warpage* is limited. Like to know more about the carbon arc method of welding?

A special handbook, "CHASE WELDING RODS—and Welding of Brass, Copper, Bronze" outlines the more recent advances in the art of welding copper and copper base alloys by the carbon arc method. Write Dept. WE-11, on your company letterhead, for a complimentary copy of this Chase handbook.

CHASE

CHASE BRASS & COPPER CO.

— Incorporated —
Waterbury 91, Connecticut

SUBSIDIARY OF KENNECOTT COPPER CORPORATION

A BANY †
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LOS ANGELES
MILWAUKEE

MINNEAPOLIS
NEWARK
NEW ORLEANS
NEW YORK
PHILADELPHIA
PITTSBURGH
PROVIDENCE
ROCHESTER †
SAN FRANCISCO
SEATTLE
ST. LOUIS
WASHINGTON †

† *Indicates Sales Office Only*

This is the Chase Network—handiest way to buy brass

Lukens Reopens Sales Office in Pittsburgh

Lukens Steel Co. and subsidiaries, By-Products Steel Corp., and Lukenweld, Inc., Coatesville, Pa., have opened sales offices in Pittsburgh to serve customers of that area. The new offices are located in Suite 2000, 429 Fourth Ave., in downtown Pittsburgh. The former Pittsburgh office was closed in 1941.

» «

Airplane Materials Used for Hand Trucks, Wheels

Northrop Gaines, Inc., Los Angeles, a wholly-owned subsidiary of Northrop Aircraft, Inc., is using airplane fabricating techniques in constructing hand trucks and industrial wheels. The first item ready for the market will be a line of cast aluminum wheels with molded rubber tires for use on hand trucks, dollies, etc. The company is also making a line of aluminum hand trucks, of the type used in railroad stations, steamship offices, hotels and warehouses for moving heavy loads.

» «

American Bridge Co. to Modernize Plant

American Bridge Co., United States Steel Corp. subsidiary, last month announced broad plans for modernization of its Gary, Ind., plant to meet increasing demands for fabricated steel in midwestern and western states. In peacetime the plant will turn out structural steel for all types of steel construction, including buildings, bridges, turntables and other similar structures. Working area will be increased by nearly 10%, and the fabricating facilities and production equipment rearranged. The welding area will be increased and centralized.

» «

Dominion Oxygen to Build New Canadian Facilities

Plans for the construction of an oxygen producing plant and an acetylene-generating plant at Vancouver, British Columbia, and the erection of an oxygen filling station at Winnipeg, Manitoba, have been announced by Dominion Oxygen Co., Ltd., a unit of Union Carbide and Carbon Corp. At the present time Dominion Oxygen has oxygen plants located at Welland, Sault Ste Marie, Toronto, Montreal and Quebec, and has acetylene-generating or charging plants at Winnipeg, Merritton and Montreal. These new facilities will complete the chain of plants across the Dominion.

» «

NOW *ANYONE* CAN GRIND THREADING TOOLS! —WITH MASTER GRINDING GAUGE!

Until the advent of the Acro Master Grinding Gauge, only a skilled mechanic could grind thread-cutting tools to the required degree of accuracy. Now anyone can do it—in less time, with less waste, with even greater precision!

The cutting tool is simply placed in slot of the Master Grinding Gauge, and thumb screws hold it tightly in place, at the proper angle, while being ground on any type of surface grinder! The Gauge is made of hardened tool steel. There are no delicate or moving parts to get out of order. Milled slots at top and bottom provide correct grinding angles. A small set screw at end, eliminates any lateral motion. There is nothing special to learn —anyone can use it!

Anyone can be "helped on the job" by Wrigley's Spearmint Gum, too, once this quality product again becomes available. Just now, no Wrigley's Spearmint Gum is being made, and until conditions permit its manufacture in quality and quantity for everyone, we again urge you, please, to "Remember the Wrigley's Spearmint wrapper." It is our pledge to you, of the finest quality and flavor in chewing gum—that *will* be back!

Acro Master Grinding Gauge

Remember this wrapper

You can get complete information from:
Acro Tool and Die Works, 4554 Broadway, Chicago 40, Ill.

Z-90

ABOUT PEOPLE

Dr. Francis C. Frary, director of research of Aluminum Co. of America, has been elected to receive the Perkin Medal in recognition of his outstanding accomplishments in the field of industrial research. This medal is given by the American Section of the Society of Chemical Industry. The presentation will take place at a dinner meeting of the society at the Hotel Commodore, New York City, on the evening of January 11, 1946. Dr. Frary is the second scientist on the staff of Aluminum Company of America to be so honored. In 1911, Charles Martin Hall was awarded the Perkin Medal for his development of the present-day process for the manufacture of aluminum.

» «

R. M. Daniels, who for a number of years has been associated with the welding industry in Chattanooga, has joined in a partnership with his brother in Shreveport, La. This organization sells arc and gas welding equipment as well as batteries and safety equipment, and it is known as the Red Ball Battery & Supply Co.

» «

J. W. Hildebrand, Jr., announces the opening of a job welding shop in Tallapoosa, Ga. He intends to specialize in farm machinery repair.

» «

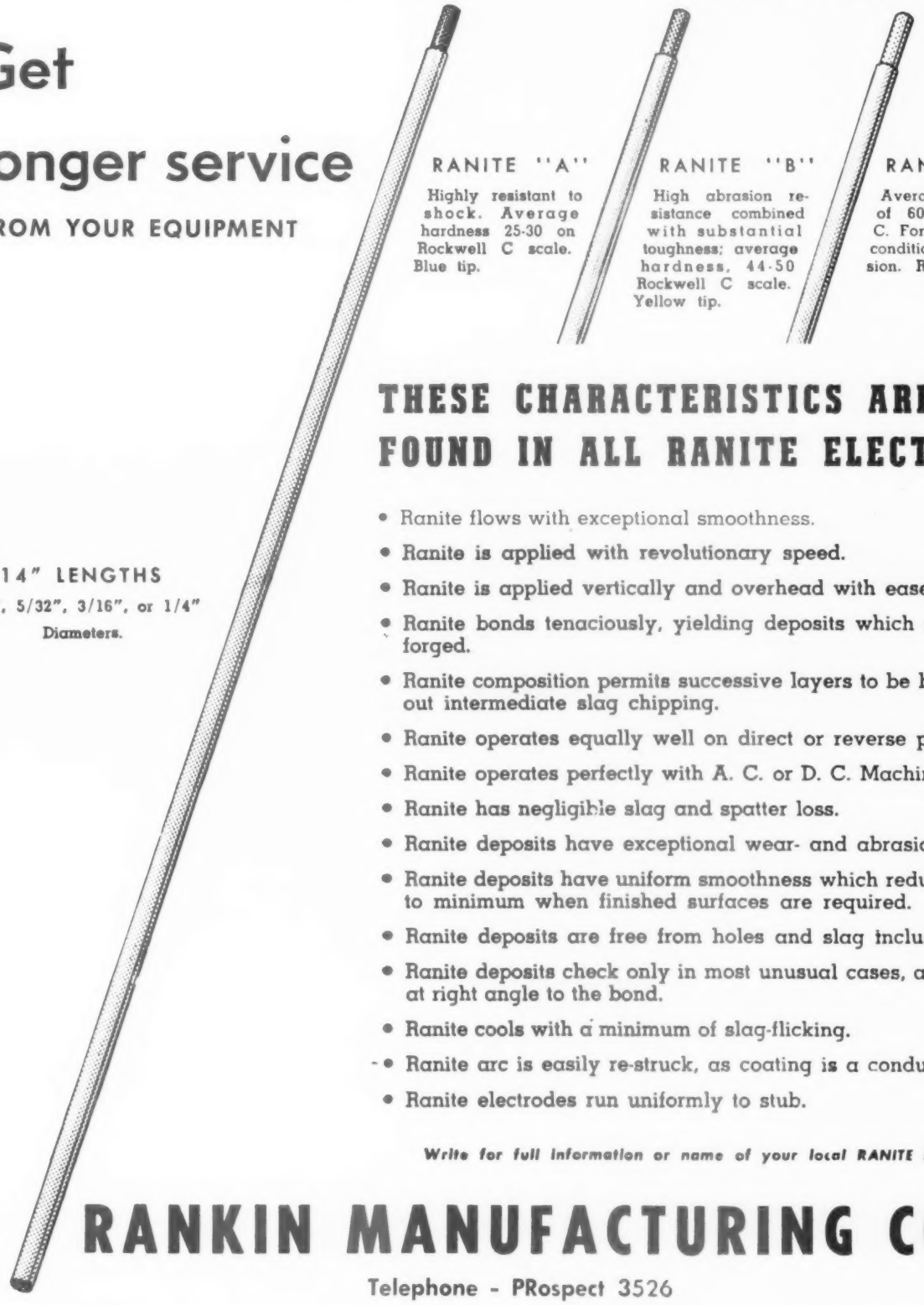
William E. Klingman has joined the Precision Welder and Machine Co., Cincinnati, as chief engineer. Until recently he was assistant sales manager of Federal Machine and Welder Co., Warren, O.

HARD-SURFACE

with Smooth-flowing RANITE

Get longer service

FROM YOUR EQUIPMENT



RANITE "A"
Highly resistant to shock. Average hardness 25-30 on Rockwell C scale. Blue tip.

RANITE "B"
High abrasion resistance combined with substantial toughness; average hardness, 44-50 Rockwell C scale. Yellow tip.

RANITE "C"
Average hardness of 60-62 Rockwell C. For most severe conditions of abrasion. Red tip.

14" LENGTHS
1/8", 5/32", 3/16", or 1/4" Diameters.

THESE CHARACTERISTICS ARE FOUND IN ALL RANITE ELECTRODES

- Ranite flows with exceptional smoothness.
- Ranite is applied with revolutionary speed.
- Ranite is applied vertically and overhead with ease.
- Ranite bonds tenaciously, yielding deposits which may be hot-forged.
- Ranite composition permits successive layers to be built up without intermediate slag chipping.
- Ranite operates equally well on direct or reverse polarity.
- Ranite operates perfectly with A. C. or D. C. Machines.
- Ranite has negligible slag and spatter loss.
- Ranite deposits have exceptional wear- and abrasion-resistance.
- Ranite deposits have uniform smoothness which reduces grinding to minimum when finished surfaces are required.
- Ranite deposits are free from holes and slag inclusions.
- Ranite deposits check only in most unusual cases, and then only at right angle to the bond.
- Ranite cools with a minimum of slag-flicking.
- Ranite arc is easily re-struck, as coating is a conductor in itself
- Ranite electrodes run uniformly to stub.

Write for full information or name of your local RANITE Distributor.

RANKIN MANUFACTURING CO.

Telephone - PRospect 3526

3072 W. Pico Blvd. **Los Angeles 6, California**

Lemore W. Clark, with the Detroit Edison Co. since 1928, has just been appointed assistant superintendent of the underground lines department. Before this appointment, Mr. Clark worked in the company's system engineering division. He is a member of the American Welding Society and the author of several technical papers on welding.

» «

Progressive Welder Co., Detroit, has enlarged its engineering staff with the appointment of **P. D. DeLeo** as development engineer, **I. A. Crawford** as research engineer and **E. Y. Bunting** as machine design engineer. Mr. DeLeo was formerly associated with Carnegie-Illinois Steel Corp. for seven years and was recently with the Federal Machine and Welder Co. as design and development engineer. Mr. Crawford was recently with The Westinghouse Electric Corp., specializing in resistance-welding equipment design and applications. Mr. Bunting was for a period of over nine years designing and welding engineer at Federal Machine and Welder Co.

» «

In accordance with its policy to provide personalized engineering service to users of welding, The Lincoln Electric Co. has added five district office representatives to its engineering staff. **John A. Smithers** is named welding engineer in the Detroit area; **W. L. Herbst** appointed welding engineer at Chattanooga; **Harold H. House** appointed welding engineer in the Moline, Ill. area; **L. B. Wallner** appointed district welding engineer at Duluth, Minn. (replacing **I. R. Bartter** who was promoted to welding engineer at Lincoln's Grand Rapids, Mich., office), and **C. M. Burnett**, welding engineer in the Boston area.

» «

Vincent Manka, formerly assisttant to the president, has been appointed general sales manager in charge of sales and advertising, Claud S. Gordon C[illegible] Chicago.

» «

Burnell Q. Burritt has been added t[illegible] the engineering staff of Craftsman Too[illegible] and Die Co., Detroit. He was formerly associated with Federal Machine an[illegible] Welder Co. as hydraulic development engineer, a position he will occupy wit[illegible] Craftsman.

» «

E. Eugene Adams, pioneer designer o[illegible] lightweight streamline trains and a vet[illegible] eran of 40 years in railroad service, ha[illegible] retired as vice-president in charge o[illegible] transportation research for Pullman Inc[illegible] and The Pullman Co. Since joining Pull[illegible] man in August, 1933, Mr. Adams had directed that organization's research department in planning advance railroad rolling stock construction, including additional streamliners. He also had supervised development of modern lightweight sleeping cars including the roomette and other room accommodation cars now in service on the nation's railroads.

» «

John C. Smith, formerly manager of manufacturing at the Canton, O., Naval Ordnance Plant, has been appointed works manager at the Center Line, Mich., Naval Ordnance Plant operated by the Westinghouse Electric Corp. **William G. Miller** will succeed Mr. Smith as manager of manufacturing at the Ohio works.

» «

Thomas J. Hilliard has been elected vice-president in charge of sales of Carnegie-Illinois Steel Corp., Chicago. Mr. Hilliard has been general manager of sales since 1938. He will be succeeded by **J. Douglas Darby**, who has been manager of sales for the company in Philadelphia since 1939. Other sales department staff changes include the appointments of **A. Paul Selby** as assistant general manager of sales and of **Wesley C. Bobbitt** as manager of sales in Philadelphia.

» «

W. S. O'Connor has been promoted to national field sales manager of the United States Gauge Co. **H. M. Bear** succeeds Mr. O'Connor as district manager of sales territory covered by the New York City office.

» «

Walter N. Fischer has been appointed to the newly created position of assistant to the general sales manager of R. G. LeTourneau, Inc., Peoria, Ill. He was formerly manager of the war contracts division.

» «

William J. Chovanec formerly a member of the engineering staff, has been appointed district sales manager for the Cincinnati territory of the Cleveland Automatic Machine Co.

» «

Miss G. D. Kile has been appointed advertising manager of the Vanadium Corp., New York City.

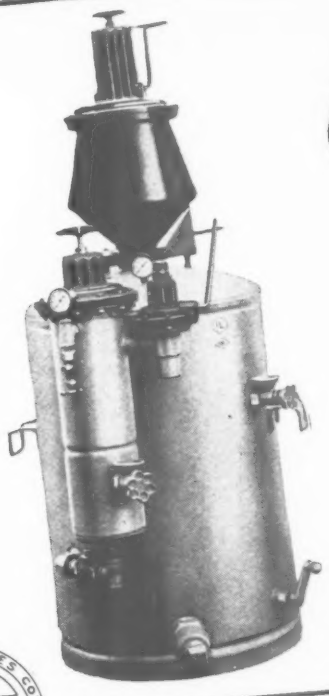
3 Reasons **Why You'll Get Faster, BETTER Welding with G-R's Your Job!**

1. **NO MAGNETIC BLOW.** You'll never have to chip out craters caused by magnetic blow, because there just "ain't no such animal" when you're using G-R's smooth, stable a. c. arc. You do better welding in corner fillets and other tight spots, too, because G-R's arc goes where you want it, with no wandering.
2. **UNIFORM ARC CHARACTERISTICS AT EVERY HEAT.** G-R's patented transformer design provides not only full-range, stepless heat control, but also uniformly excellent arc characteristics at every heat — not "stringy" at low heats and "wild" at high, but smooth and easy-to-handle at every point in the range.
3. **TOP QUALITY WELDS IN ALL POSITIONS.** With the correct electrodes, you can do better welding with G-R's in ANY position — overhead, down-hand or up-hand vertical, or flat. And you'll do it FASTER, too!

G-R's are available in standard models from 100 to 2,500 amp. ratings, for manual or automatic welding. For details, prices and delivery information, see your nearby G-R distributor, or write directly to:

GLENN-ROBERTS COMPANY
3100 E. TENTH STREET • OAKLAND 1, CALIFORNIA
2107 ADAMS STREET • INDIANAPOLIS 1, INDIANA

One of these
Portable Acetylene Generators
...will serve you better



TYPE "A"

TYPE "P"

AIR REDUCTION SALES COMPANY — LISTED UNDER Underwriters Laboratories — RE-EXAMINATION SERVICE — NEW YORK

TODAY'S requirements for increased production and operating economy will be more easily met with one of these Airco Portable Acetylene Generators. Sturdily built, highly efficient and low in cost, they are designed to supply sufficient gas for use with oxy-acetylene welding or cutting equipment.

These generators are practically identical in design, the principal differences being that Type "P", slightly higher priced, contains a carbide observation window in the hopper and a water circulating device.

Each generator is equipped with a built-in pressure control valve which can quickly be set to deliver and maintain the exact pressure required. Such controlled regulation ends the need for frequent readjustment of torch valves to compensate for variations in delivery pressure — thus the operator can devote all his attention to the work of welding or cutting.

Both the Airco Type "A" and Type "P" are made in 3 sizes, each approved for double-rated operation: 15-lb. size, 30 cu. ft. per hour; 30-lb. size, 60 cu. ft. per hour; 50-lb. size, 100 cu. ft. per hour.

For complete details regarding the Airco Type "A" or Type "P", ask your nearby Airco office — or write for bulletin ADC 619-A. Address Dept. WE, Air Reduction, General Offices: 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Co. General Offices: Houston 1, Texas. Represented Internationally by Airco Export Corporation.

AIR REDUCTION

Offices in All Principal Cities

USE NATIONAL CARBIDE FOR HIGHEST ACETYLENE YIELD

AIRCO

Portable ACETYLENE GENERATORS

William Sheldrick, who has been an official of Babcock & Wilcox for 46 years, has retired and is succeeded by **W. G. Dryden** as treasurer and assistant secretary of The Babcock & Wilcox Co. and The Babcock & Wilcox Tube Co. **C. H. Clash** has been appointed assistant secretary of The Babcock & Wilcox Co., succeeding **F. H. Holloway**, resigned.

Executives who will direct the peacetime operations of the Ford Motor Co. were designated recently by Henry Ford II, president. **J. S. Bugas** will head industrial relations, a division which previously had not been identified by that name. **H. H. Bennett** will serve in a consulting and advisory capacity and continue as director. **M. L. Bricker** has been placed in charge of both productive and non-productive manufacturing. **R. R. Rausch** has been assigned to work with Mr. Bricker on major construction projects. **J. R. Davis** will head sales and advertising; **C. H. Carroll**, purchasing; **R. H. McCarroll**, engineering; **R. I. Roberge**, foreign operations; and **B. J. Craig** and **H. L. Moekle**, accounting, auditing and finance.

W. E. Mullestein has been appointed manager of the Coatesville district sales office of Lukens Steel Co. and subsidiaries, By-Products Steel Corp. and Lukenweld, Inc., Coatesville, Pa. He succeeds **William C. Simpson** who was recently named manager of sales of Lukenweld, Inc. Mullestein has been on leave from the Lukens organization, serving in Europe with the Strategic Bombing Survey of the War Department.

R. N. Landreth has been appointed assistant to the vice-president of the general machinery division of the Allis-Chalmers Mfg. Co. Mr. Landreth, who has been special representative for the company, will continue to reside in Washington, D. C.

R. B. Petty, C. G. Smith and **W. R. Graham-Smith** have been added to the field service staff of the Diversey Corp., Chicago. Mr. Petty will cover the Los Angeles area. Mr. Smith will work from Fort Wayne, Ind., and Mr. Graham-Smith has been assigned a territory in Canada.

W. J. Davidson, who has been associated with the projected General Motors Technical Center at Detroit since its inception, will be administrative engineer. He will be aided by **Col. A. J. Schamehorn** as assistant administrative engineer. Messrs. Davidson and Schamehorn will have supervision over the construction, equipment and maintenance of the Technical Center, working under **C. L. McCuen**, vice-president in charge of the G-M central engineering staff. **Lyle A. Walsh** has been appointed manager of operations, advanced engineering section.

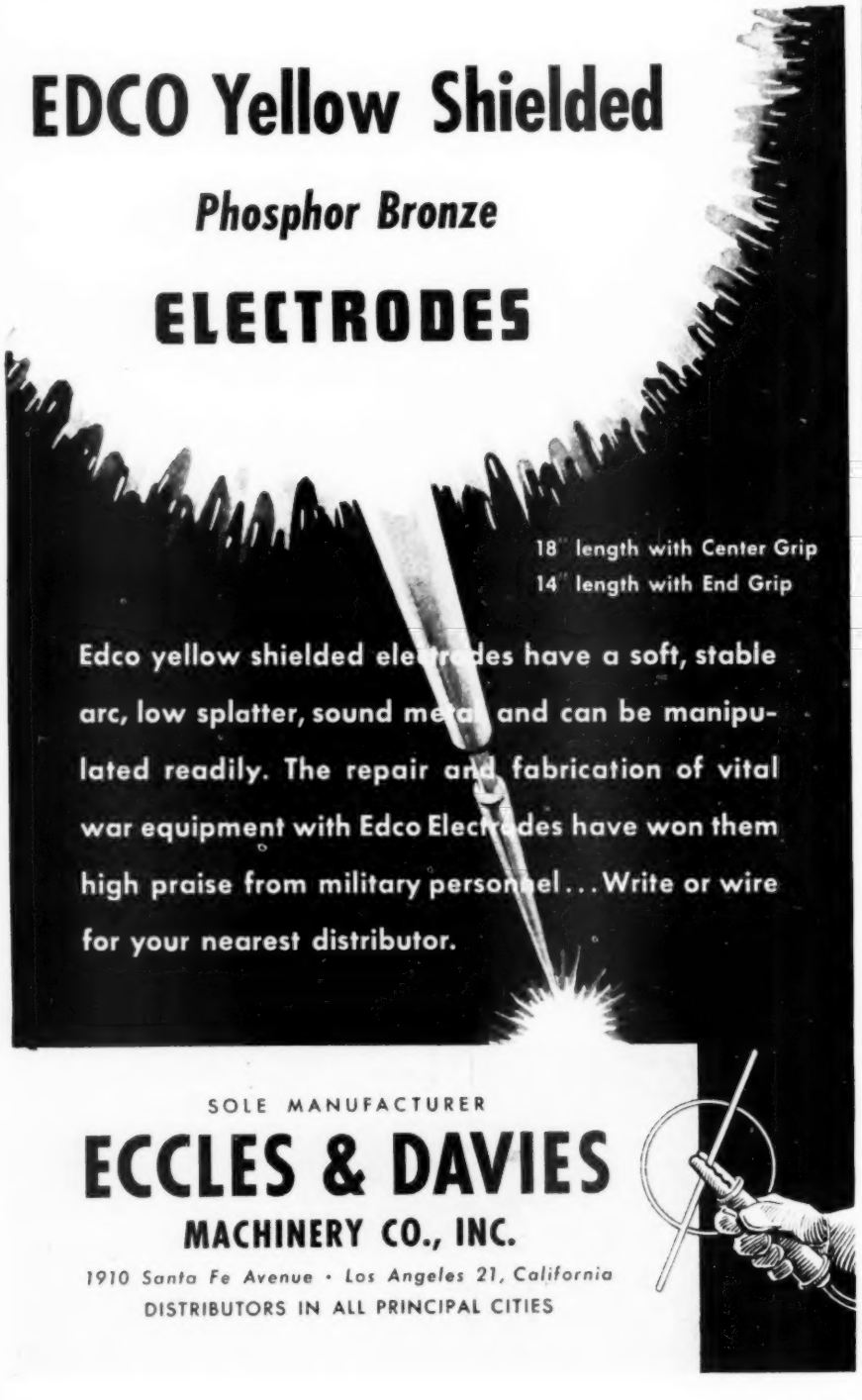
Herbert R. Isenburger, St. John X-Ray Service, Inc., Long Island City, N. Y., has been appointed to the editorial advisory board of *The Engineers' Digest*.

H. A. Squibbs formerly assistant general manager of sales in Chicago for American Steel and Wire Co., has been made assistant to the sales vice-president, and **C. T. Gilchrist** has been promoted to succeed him. Mr. Gilchrist was formerly of the manufacturers products sales division in Chicago.

James V. Winkler, formerly in charge of experimental engineering at the magnesium fabrication laboratory of Dow Chemical Co. in Bay City, Mich., has been transferred to the Dow Chemical Los Angeles staff as development engineer for magnesium on the west coast.

Harry M. Francis, formerly deputy director of the steel division of WPB, has returned to American Steel & Wire Co., Cleveland, to resume his duties as assistant vice-president, sales.

E. A. Murray has been appointed manager of the manufacturers products department in the Chicago sales office of the American Steel & Wire Co. **C. J. Quill** has been named assistant manager of the department.


EDCO Yellow Shielded
Phosphor Bronze
ELECTRODES
18" length with Center Grip
14" length with End Grip
Edco yellow shielded electrodes have a soft, stable arc, low splatter, sound metal and can be manipulated readily. The repair and fabrication of vital war equipment with Edco Electrodes have won them high praise from military personnel... Write or wire for your nearest distributor.
SOLE MANUFACTURER
ECCLES & DAVIES
MACHINERY CO., INC.
1910 Santa Fe Avenue · Los Angeles 21, California
DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wear Resistance?
IMPACT?
ABRASION?
Finish?
Hard-Facing
THIS MONTH'S WEAR PROBLEM:
CEMENT CONVEYOR SCREWS
Selecting the proper hard-facing alloy for any job must always be based upon operating conditions, which vary infinitely between applications. CEMENT CONVEYOR SCREWS, for example, must withstand:
● HEAVY ABRASION of steel against cement dust and particles.
● INTENSE HEAT from drying kilns.

CEMENT conveyor screws fight a constant battle against abrasion, often complicated by heat. The fine dust and particles of cement cut away flights as effectively as an emery wheel. As flights lose size, carrying efficiency is also lost. And heat from clinkers does not ease operating conditions.

For all-round wear resistance when heat is a factor, Stoody 6 furnishes best protection on conveyor screws. Stoody 6 is a non-ferrous alloy composed of cobalt chromium and tungsten. It is easily applied; forms smooth, non-porous deposits; retains hardness even at red heat and possesses outstanding wear characteristics.

Stoody 6 is available bare for oxy-acetylene application and in new coated rods for AC-DC electric application. 3/16" rod sizes are priced at $4.25 per pound. Order 10 pounds of Stoody 6 as a trial—it resists abrasion—saves equipment—wherever heat impact or corrosion complicate wear problems.

The $300 cement conveyor screw illustrated above normally lasted only 10 days. At a total cost of only forty dollars, STOODY "6" kept this screw in operation for 60 days—saving approximately $1,500 in a single application! Conveyor screws can be re-hardfaced as required, thus prolonging life indefinitely.

STOODY COMPANY
1141 WEST SLAUSON AVENUE, WHITTIER, CALIFORNIA

STOODY HARD-FACING ALLOYS
Retard Wear — Save Repair

Now! splice your WELDING CABLE

Easily — Quickly — without Soldering or Rigid Connections

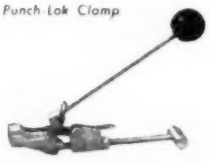
with the

PUNCH-LOK

Streamlined

BANDING METHOD

Punch-Lok Clamp



Loking Tool

Punch-Lok Clamps and Loking Tool will splice that broken cable. You can tie, reinforce, connect, mend and make scores of other applications. Easy, fast, safe, economical. No normal pull strain can tear it loose. Punch-Lok Method will save you time and money.

Write for descriptive catalog and name of nearest distributor.

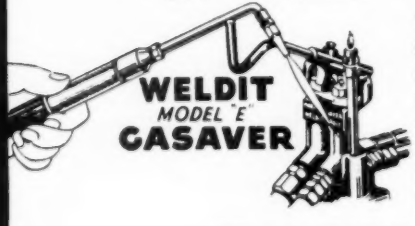
KEEP BUYING WAR BONDS

PUNCH-LOK COMPANY

Dept. E, 321 North Justine Street, Chicago 7, Illinois

Safe Welding

AT LOWER PRODUCTION COSTS



The Weldit Gasaver shuts off the welding flame when not in use. . . . Conserves essential materials by cutting oxygen and acetylene consumption as much as *fifty* per cent. Prevents injury to workmen—or sudden fires—from dangerous idle torch flames. . . . Adjustment remains unaltered between welds.

When the Weldit Gasaver has been installed, you simply hang idle torch on the handy lever rod. Weight of torch pulls rod down, thus automatically shutting off supply lines. Relight instantly by passing torch over Gasaver pilot light. No bother. . . . No time lost. . . . *No readjusting required.* . . . Price $10.00 at Detroit. Order today.

Better Soldering, Annealing and Heating Jobs

The Weldit Model CW Blowpipe is in daily use by many foremost industrial plants. . . . Built in accordance with the recommendations of leading fabricators of sheet metal products. . . . Operates on either natural gas, manufactured gas, or other low temperature fuel gas and compressed air. Stands up under rough shop use. . . . Send for literature.

WELDIT INC.

628 BAGLEY AVENUE • DETROIT 26, MICH.

H. Y. Satterlee, formerly assistant sales manager for Edo Aircraft Corp., has been appointed sales manager of Pacific Engineering Corp., Los Angeles.

» «

Fred C. Smith, has been appointed director of quality of Tube Turns, Inc., Louisville. Prior to joining Tube Turns in January, 1943, as chief metallurgist, Mr. Smith was field metallurgist for Carnegie-Illinois. He is a member of AWS.

» «

James G. Vail, vice-president and director of the Philadelphia Quartz Co., Philadelphia, recently celebrated 40 years of continuous service with this company. His fellow directors and associates tendered a testimonial luncheon in his honor.

» «

Arthur H. Brown, who has been associated with Lukens Steel Co. and subsidiaries since 1930, has been named manager of sales for Pittsburgh and vicinity.

» «

Dr. Russell A. Nielsen, Portland, Ore., formerly a research engineer for Westinghouse Electric Corp. at East Pittsburgh, heads the company's new Pacific Coast high-frequency laboratory.

» «

John Graham has been appointed general manager of sales, American Steel & Wire Co., Cleveland. **R. F. Curtis,** formerly assistant manager of the products division, is named manager of that division to succeed Mr. Graham. **Norman Sted,** formerly in Cleveland district sales, becomes assistant manager under Mr. Curtis.

» «

David F. Austin has been appointed sales vice-president, United States Steel Corp. of Delaware. He had been acting vice-president since June, 1945, during which time he continued as vice-president in charge of sales, Carnegie-Illinois Steel Corp.

» «

Arthur R. Tofte has been named manager of the advertising and public relations department Allis-Chalmers Mfg. Co. Tofte a member of the department since 1938, succeeds **George J. Callos,** who resigned to become vice-president and account executive for Klau-Van Pieterson-Dunlap Associates, Inc., Milwaukee advertising agency.

» «

Died . . .

W. S. Evans, materials process engineer at the St. Louis plant of the Curtiss Wright Airplane Division, died July 7th after a short illness. Prior to becoming associated with Curtiss Wright, he had been with Douglas and Northrop Aircraft. Mr. Evans had been well known for the welding procedures he developed for the aircraft industry. His work was especially concerned with arc welding and automatic welding and more recently with automatic arc welding by the inert gas-shielded process.

WITH THE WAR OVER—and RECONVERSION IN HIGH GEAR—*Don't Overlook Your* RESISTANCE—WELDING CONTROL NEEDS!

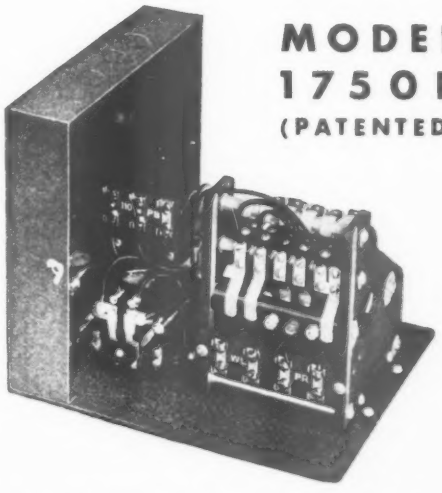
Here is the

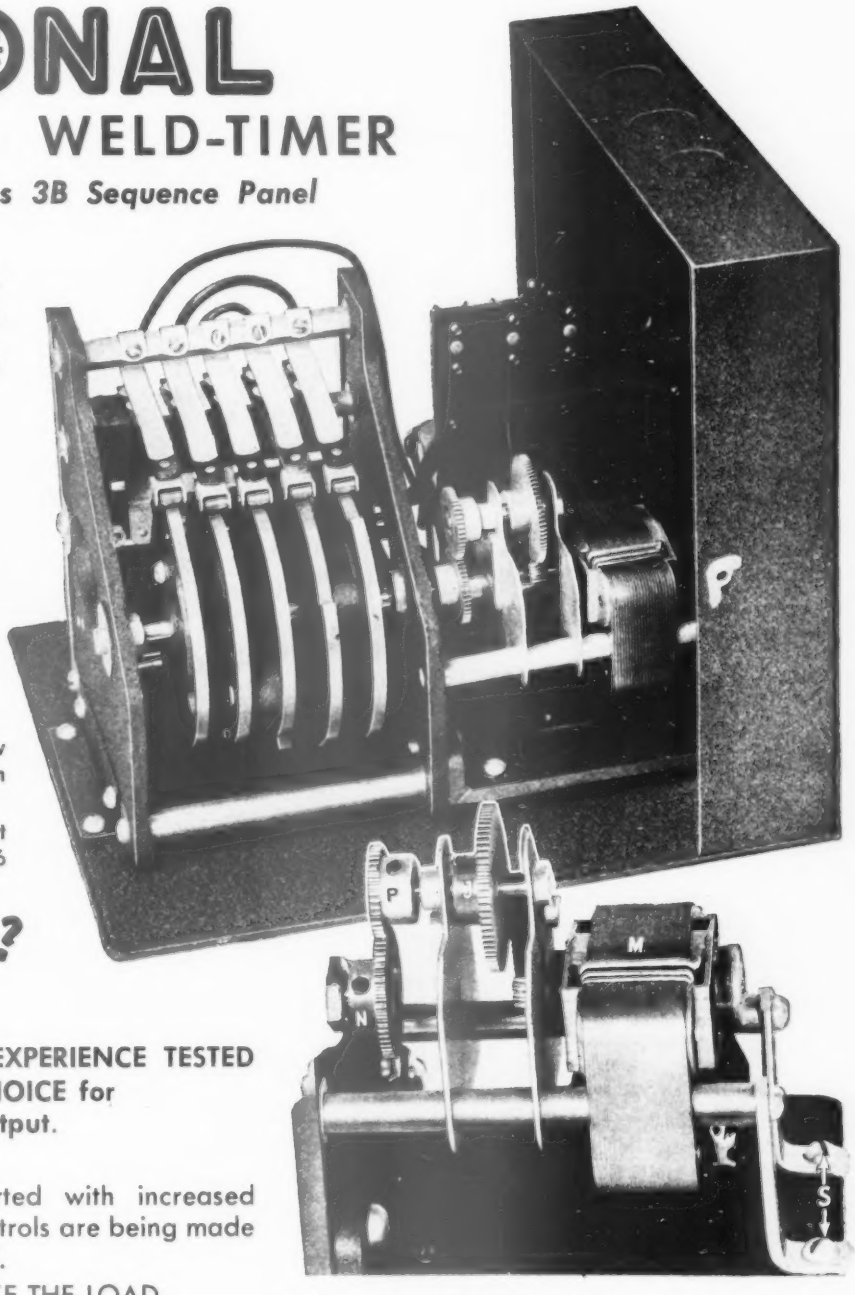
NATIONAL

Mass-Production WELD-TIMER

The Complete NEMA class 3B Sequence Panel

MODEL 1750P (PATENTED)





Our BIGGEST Seller in Pre-War, Now Shaping Up, to Repeat This Record in Post-War Re-Tooling.

When our pre-war customers start right in, and again buy this Timer for 1946 production

What's the Answer?

IT'S GOOD—
IT IS THE BEST—
IT HAS BEEN EXPERIENCE TESTED
It is Industry's FIRST CHOICE for Speedy Civilian Output.

And HERE is the Best News—

NATIONAL plants have re-converted with increased facilities. Deliveries of Welding Controls are being made promptly, in spite of heavy demand.

NATIONAL controls are built to TAKE THE LOAD.
1945 Models have added refinements.
No other Timer offers these 4 features:
SIMPLICITY - PRECISION - PERFORMANCE - LOW COST.
In 1941, NATIONAL led in Weld-Timer volume.
In 1946, we expect to RETAIN that leadership.

3 views of National Type 1750P Timer, that regulates the Pressure—Weld—Hold and "Off" Time.
Upper left, the control circuit and wire terminals.
Upper right, the complete unit, motor and cam assembly, which operates on National's exclusive Double-cam-per-circuit Time Control of "Drop-to-make" off one cam, then "Drop-to-break" off #2 cam. **Below,** the motive power and speed regulating gear train. 2 change gears P & N alter the welding rate, from 35 to 300 spots per minute in 24 easy stages.

NATIONAL TIME & SIGNAL CORPORATION

600 E. MILWAUKEE AVENUE **DETROIT 2, MICHIGAN**

are you looking for an

EXCELLENT HARD FACING *electrode?*

AGILE

DARK GREEN ELECTRODES

can be applied to the worn surfaces and edges of steel, malleable and cast-iron. The weld is a chromium-carbon steel with high hardness which gives excellent wear resistance. This electrode performs equally well with AC or DC welding machines.

APPLICATION: We recommend this electrode for the hard facing of:—machine parts, excavating buckets, plows, shovel teeth, worn tools, switches, crossovers, valves, dies, etc.

ANNEALING: 10-15 hours at 1460° F. and slow cooling will reduce the hardness of the weld metal from 600 to 280 Brinell.

FORGING: The weld deposit can be forged at 1800° F.

PRICES: AGILE Dark Green electrodes are packaged in 10-lb. containers at the following prices per pound:

3/16" diameter	$ .52 per lb.
5/32" diameter	.56 per lb.
1/8" diameter	.60 per lb.

AGILE ACTARC

AMERICAN AGILE CORPORATION
5806 HOUGH AVE.
CLEVELAND 3, OHIO

Helpful Literature Just Published

The following reviews are of recent publications of interest to those in the welding industry. Unless otherwise stated, they may be obtained without cost by writing to the manufacturers listed.

New Instruction Code

AWS has just issued a revised edition of its "Part A—Arc Welding of Steel 3/8 to 3/4 in. Thick," code of minimum requirements for instruction of welding operators. This arc-welding instruction code was first issued in July, 1942, and found a widespread application in the training of weldors for war production. The revision was undertaken to make the code more applicable to the postwar training of weldors, including returning veterans. Primarily, the revision embodies a modification of the manner of presentation although some changes have been made in the exercises and lecture information to provide a more inclusive course. Paper cover; 92 pages; 6 by 9 in.; price 50¢ per copy. **American Welding Society,** 33 West 39th St., New York City 18.

» «

Flash Welding Steel Barrels

A 16-page, letterhead-size booklet, attractively printed in two colors, describes the flash welding of steel containers, and specifically barrels. The machine doing the work pictured is a specially designed automatic "barrel welder" having a rating of 350 kva. It is capable of flash welding the butt seams of 55-gallon drums at a production rate of up to 300 per hour. Other types of machines are also described and a schematic layout of a barrel plant is given. **The Federal Machine and Welder Co.,** 212 Dana St., Warren, O.

» «

Oxygen Plant Bulletin

"Making Your Own Oxygen" is the title of a 12-page, two-color, letterhead-size bulletin describing a compact oxygen-generating system that, manufacturer declares, is no more difficult to operate than an air compressor. Three units are included: (1) air compressor, (2) air purifier, (3) air separator and oxygen compressing unit. **Air Products, Inc.,** Manufacturers Road, Chattanooga 5.

» «

Stud-Welding Folder

A four-page letterhead-size folder describes stud-welding applications and developments. Among the uses of welded studs suggested are: inspection covers; locomotive storm curtains; electrical outlet boxes, circuit breakers, switch boxes, etc.; securing sheet metal to protective insulation; reinforcing for concrete; bubble tower caps; wiring, conduit and pipe; securing wood floorings to metal beams; removable gratings; sheet-metal roofing; and many other uses. The different types of studs available include: metal-lath studs, rectangular metal-lath studs, grooved studs to obtain shorter lengths, grooved studs for plug welding, reduced-base studs, hook studs and eye-bolt studs. **Nelson Specialty Welding Equipment Corp.,** 440 Peralta Ave., San Leandro, Calif.

» «

Silver-Brazing Booklet

The patented "Silbraz" joint for I.P.S. copper tubing and brass pipes is the subject of a 16-page, two-color booklet, "How to Cash in on the Silver Alloy Ring." These joints are effected with patented bronze fittings—couplings, ells, tees, crosses, etc.—furnished with pre-inserted silver-alloy rings in their port openings. The brass or copper tubing is inserted within the selected fitting, and the assembly is brazed by heating it with an oxy-acetylene torch. When the joint is completed, a narrow fillet of silvery alloy is visible on the outside of the fitting to serve as the identifying mark of this type of joint. Detailed brazing instructions are given in the booklet, No. ADG-2017. **Air Reduction Sales Co.,** 60 East 42nd St., New York City 17.

» «

Arc-Welding Instruction

"Building Your Career in Arc Welding," a ten-page, letterhead-size booklet, and "The Lincoln Courses in Welding Engineering," a two-page leaflet, have been issued to explain the instruction and training courses which are being offered at the Lincoln welding school. These two pieces fully outline the company's educational program. **The Lincoln Electric Co.,** 12818 Coit Road, Cleveland 1.

» «

Welded Penstock Comparison

An engineering paper, "Design of an Arc-Welded Penstock of Nickel-Clad Steel," has been reprinted as a 16-page, letterhead-size pamphlet by **Lukens Steel Co.,** Coatesville, Pa. It is the purpose of this paper to determine the various economies and benefits of the nickel-clad steel penstock over one of conventional plate steel. The author, Alfred Ernest Bratfisch, is in charge of hydraulic designs of hydro-power plants, department of water and power, City of Los Angeles.

Your Thumbnail is 40 times THICKER than the BOND

MAGNIFIED 500 times, this photo-micrograph shows the fine grain structure of MIR-O-COL Hard-Facing. The heavy dark portion is the parent metal; thin clear band, the bond; and the rest, the deposited alloy.

BECAUSE MIR-O-COL Hard-Facing alloys flow readily when correct welding heat is applied, penetration of the parent metal at the interface averages about .0007 of an inch. Dilution is minimized, as the photo-micrograph (above) shows. The consulting metallurgist who prepared this impartial study of MIR-O-COL No. 2 hard-facing, states that the ferritic grain structure of the hard-facing (light area above) consists of cementite and martensite . . . which combine to give MIR-O-COL alloys their hardness. This hardness, fused at the moment of impingement of either electric or acetylene torch, can form a protective layer of high-alloy metal over wearing surfaces of your equipment. Scrapers, cutters, material-handling rollers and buckets—in fact, almost any type of apparatus or equipment subjected to constant wear from abrasion, erosion or corrosion—can be economically hard-faced. In almost every recorded instance, maintenance costs have dropped, production records gone up, and equipment capitalization minimized by using this dollar-saving MIR-O-COL Hard-Facing, applied easily to iron or steel. Learn more about hard-facing for profit. Write today for your FREE copy of "Weldors' Guide to Successful Hard-Facing." Address Department B-18.

MIR-O-COL
HARD-FACING RODS
ALLOY COMPANY
2416-60 EAST 53RD STREET, LOS ANGELES 11, CALIFORNIA

MAIN OFFICE	EXPORT OFFICE
2416-60 East 53rd Street, Los Angeles 11, California	American Steel Export Co., Inc. 347 Madison Ave., New York 17, N. Y. 448 S. Hill St., Los Angeles 13, Calif.

WeldOlet Fittings Catalog

A new 16-page, letterhead-size, two-color catalog on "WeldOlet" fittings contains complete application information, structural data, installation procedure, specifications and list prices. This line of fittings is used for making leakproof welded branch-pipe joints of various types. **Bonney Forge & Tool Works,** Forged Fittings Div., Allentown, Pa., Dept. 265.

» «

Walco Price Lists

Two new looseleaf price lists punched for catalog insertion have been issued on "Walco" aluminum welding rods, electrodes, brazing alloy, brazing flux, welding lenses, etc. **Welding Alloys Mfg. Co.,** 744 Broad St., Newark 2.

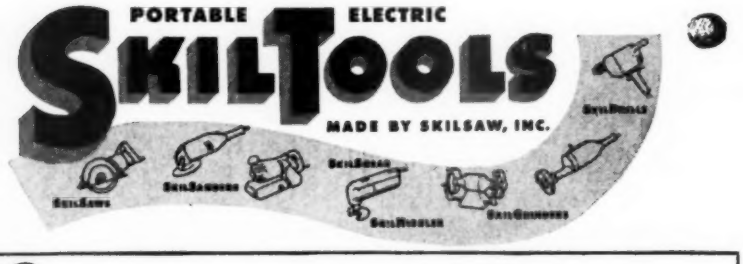
» «

Flexible-Shaft Booklet

A 42-page, letterhead-size, spirally bound book, "Stow Flexible-Shaft Remote Valve Operating Gear," contains much new data regarding this use of flexible shafting. The manual covers in detail the construction of the core and case for different conditions and includes a new series of assembly drawings. Instructions for making shafts from mill lengths are also included. **Stow Mfg. Co.,** Binghamton, N. Y.

BOTH OF THESE TOOLS ... are compact, light weight (up to 3 lbs. lighter than other tools of similar capacity) ... amply powered for fast cutting of hot rolled steel up to recommended capacity, softer materials in proportion ... cool running, comfortable to the hand ... elimination of customary handle gives operator complete control of tool in all positions. Ask your distributor today for a demonstration.

SKILSAW, INC.
5033-43 Elston Ave., Chicago 30, Ill. • *Factory Branches in All Principal Cities*



PLANNING RETOOLING

Let SKILTOOL Field Engineers help you now to plan "tooling-up" for more efficient and economical peacetime production with SKILSAW'S new postwar tools.

Trindl Catalog Sheets

Several new letterhead-size catalog sheets have been published by **Trindl Products Ltd.,** 17 East 23rd St., Chicago 16. These cover an arc torch, a line of arc welders and accessories such as helmets, hand shields, welding lenses, goggles, clamps, electrode holders, gloves, welding cable and chipping hammers.

» «

Grinder Broadside

Norton grinding and lapping machines used in the production of electric refrigeration and air-conditioning units are described and pictured in a handsomely printed two-color broadside unfolding to a size of 17 by 22 in. **Norton Company,** Worcester 6, Mass.

» «

"Industrial Logistics"

"Industrial Logistics—A Survey for Management" is the title of a 12-page, letterhead-size, three-color pamphlet explaining how a planned system of materials transportation can reduce costs in the procurement, production and distribution of goods. Examples of outstanding economies are cited: $20.65 saved per car in unloading sheet metal, $41 per car saved in unloading bagged materials, $64 a day saved through utilizing full warehouse capacity, etc. **The Elwell-Parker Electric Co.,** 4205 St. Clair Ave., Cleveland 14.

» «

Steel Products Manual

Sections 10 and 14 of the "Steel Products Manual" have been revised as of June, 1945. Last previous revisions were as of February, 1943, and February, 1942, respectively. Section 10 covers hot-rolled alloy steels; open-hearth and electric-furnace bars, bar-strip, billets, blooms and slabs. Section 14 covers tin mill products: tin plate, terne plate and back plate. The two sections are available at 25c each, postpaid, from **American Iron and Steel Institute,** 350 Fifth Ave., New York City 1.

» «

Resistance-Welder Catalog

A 20-page pocket catalog, 4 by 9 in., covers the highlights of the Taylor-Winfield line of spot welders, press welders, bench welders, welding guns, seam welders, flash-butt welders and other resistance-welding equipment. **The Taylor-Winfield Corp.,** Warren, O.

» «

Underwater Cutting Folder

A four-page, letterhead-size, two-color circular on arc-oxygen cutting and welding pictures the equipment necessary and gives the fundamental principles of operation. This type of underwater cutting uses a tubular electrode, through the bore of which a continuous jet of oxygen is discharged into the arc. **Chicago Tool and Engineering Co.,** 8383 South Chicago Ave., Chicago 17.

Now—MATCH THEIR BEST WITH YOUR MOST IN THE VICTORY LOAN!

Top off your good work on your Payroll Savings Plan with an outstanding showing in the Victory Loan—our last all-out effort!

Help bring our boys back to the homes for which they fought—and give our wounded heroes the best of medical care—by backing the Victory Loan! You know your quota! You also know by past war-loan experience that your personal effort and plant solicitation are required to make your quota.

Sell the New F.D. Roosevelt Memorial $200 Bond through your PAYROLL SAVINGS PLAN!

In rallies, interdepartmental contests, and solicitations, promote the new Franklin Delano Roosevelt Memorial $200 Bond! Better than "cash in hand," Victory Bonds enable the buyers to build for the future—assure a needed nest egg for old age.

Keep on giving YOUR MOST to the Victory Loan! All Bond payroll deductions during November and December will be credited to your quota. Every Victory Bond is a "Thank You" to our battle-weary men overseas—also a definite aid in making their dreams of home come true! Get behind the Victory Loan to promote peacetime prosperity for our returning veterans, your nation, your employees--and your own industry!

The Treasury Department acknowledges with appreciation the publication of this message by

THE WELDING ENGINEER

Clear Vision

THROUGH
THERMACOTE COVER LENSES
INCREASES
WELDING FOOTAGE

The un-retouched picture above was photographed through an uncoated cover glass on which is one hour's accumulation of weld spatter under average conditions.

This picture was photographed through a THERMACOTE plastic-coated cover lens that had been used, under identical conditions, for THREE WEEKS.

When welding with non-coated or lacquered cover glasses visibility decreases and eye-strain increases as weld spatter accumulates on the glass. Increased welding footage is the logical result of constantly clear vision through the use of THERMACOTE COVER LENSES.

THERMACOTE CO.

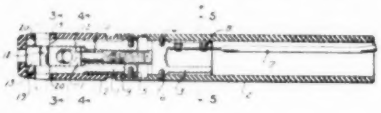
NEWARK CHICAGO
LOS ANGELES PORTLAND

FROM THE PATENT OFFICE

Electrode Holder

2,386,398. **Honel A. Jackson,** Detroit. Filed Feb. 4, 1944. Issued Oct. 9, 1945.

A holder for an arc-welding electrode comprising a head having a longitudinal opening therein. One portion of the open-

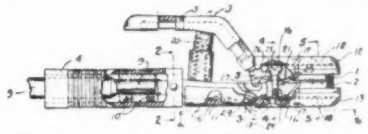


ing is threaded, and another portion is of polygonal cross-section. A threaded handle shank has a screw that fits in the threaded portion of the bore; shank also has an end adapted to project into the other portion of the bore. A slidable block in the polygonal portion of the bore is arranged to abut the handle and can be moved outwardly of the polygonal portion when the handle shank is turned in the head. The locking block has a V-groove in its outer end and also an oblique opening; opposed openings in the head communicate with the longitudinal opening adjacent the V-groove and are arranged to coöperate with it. Obliquely opposed openings in the head communicate with the longitudinal bore adjacent the oblique opening and are arranged to coöperate with it so that an electrode can be optionally locked in the V-groove and the first set of openings, or in the oblique opening and the set of obliquely opposed openings, upon turning the handle shank to move the locking block outwardly.

Electrode Holder

2,386,399. **Honel A. Jackson,** Detroit. Filed Feb. 18, 1944. Issued Oct. 9, 1945.

In a holder for welding electrodes, the combination comprising: jaws adapted to grip an electrode; a pivotal connection



in the form of a socket extending inwardly from the outer face of one of the jaws and spaced longitudinally from the outer end of the jaw and positioned entirely within the sides of the jaw; an opening extending outwardly from the inner face of the jaw and communicating with the socket and a pivot member. The latter extends through the socket and opening and is secured to the other jaw between the side faces, bearing pivotally in the socket of the first jaw. The pivot member extends substantially perpendicular to the axis of pivoting of the jaws which can be swung about to open them for reception of an electrode.

Arctrol

MORE WORK
***With Less* WORK!**

INSTANT CONTROL
FOOT CONTROL
FASTER WORK
SAVES TIME
LESS FATIGUE
SAVES LABOR

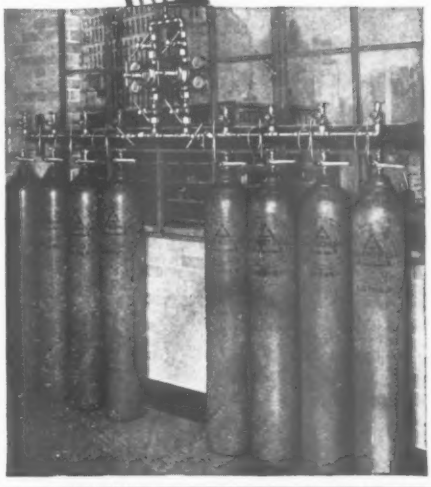
"Arctrol" regulates the generator output from full-rated current down to snuffing it out completely. It permits the welder to adjust the current for varying thicknesses of metal and for different welding positions . . . merely by moving the foot pedal. Craters are eliminated by "snuffing" out the current as the weld is completed.

Ask your Welding Supply Jobber or write for Data Sheets and Prices.
Specify welding equipment you use.

MULLENBACH ELECTRICAL MFG. CO.

2300 E. 27TH ST. LOS ANGELES 11 CALIFORNIA

Are YOUR WELDING OPERATIONS LIKE A TRAFFIC LIGHT?



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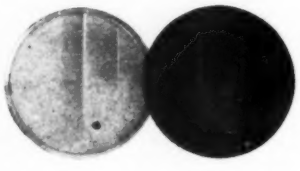

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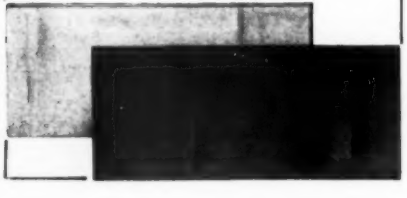
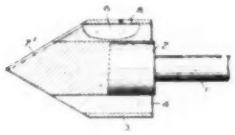


Soldering Iron

2,382,390. **Seymour Bergman,** Dover, N. J. Filed Dec. 17, 1942. Issued Aug. 14, 1945.

A soldering iron with a shank having



a heating element formed with a tapered front end. A collar surrounds the heating element and terminates at its forward end at the inner end of a groove in the tapered portion. Collar has a tapered forward end and a solder-receiving well in its periphery and a solder passage in its tapered portion. The latter opens at its upper end into the well and registers at its lower end with the groove in the tapered portion of the heating element so as to form a continuous passage for the molten solder from the well to the apex of the heating element. Surrounding the collar is a means for retaining the molten solder in the well in various positions of the iron.

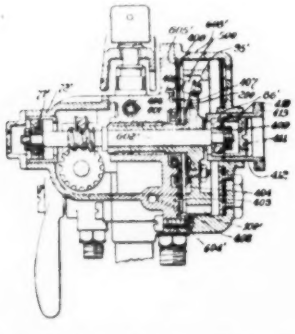
» «

Hose Clamp

2,383,199. **William Kitts,** Los Angeles, assigned to **Adel Precision Products Corp.** Filed Aug. 20, 1943. Issued Aug. 21, 1945.

In a hose clamp, a rotary winding shaft supported on a body member and a flexible clamping band adapted to be wound on the shaft. One end of the band is fixed to the shaft and the other end is fixed to the body member. An arcuate hose-engaging shoe is fixed in such fashion that it will be disposed between the hose and the body member when the latter is connected with the band. There is also a means for releasably holding the shaft against unwinding.

» «



Metallizing Motor Governor

2,382,111. **Arthur P. Shepard,** Flushing, and **Herbert S. Ingham,** Queens Village, N. Y., assigned to **Metallizing Engineering Co., Inc.,** Long Island City, N. Y. Filed Dec. 1, 1941. Issued Aug. 14, 1945.

A variable speed-governing mechanism for a metal spray gun of the type having a compressed-gas motor. It comprises a first means rotatable with the rotor of the motor and centrifugally movable against spring resistance and a second means composed of at least one first and one second element. The first element is positioned and adapted to be acted upon by the first means, upon centrifugal actuation thereof, to coöperate by mechanical movement and frictional contact with the second element to actuate the latter to restrict the compressed gas supplied to the rotor of the motor. The relative position between the second element and the initial position of the first element can be adjusted within a range defined by the centrifugal movement of the first means between the minimum and maximum operating speeds of the rotor.

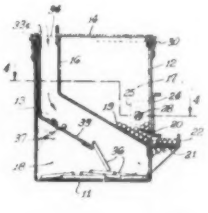
» «

Metallizing Motor Governor

2,381,931. **Arthur P. Shepard,** Forest Hills, and **Herbert S. Ingham,** Flushing, N. Y., assigned to **Metallizing Engineering Co., Inc.,** Long Island City, N. Y. Filed Dec. 1, 1941. Issued Aug. 14, 1945.

A variable speed-governing mechanism for a metal spray gun of the type having a compressed-gas motor. It includes an arm that is rotatable with the rotor of the motor and centrifugally deflectable against spring resistance. The speed control means is composed of one first and one second element; the first element is adapted to be acted upon by the arm, upon centrifugal actuation of the latter, to coöperate by mechanical movement with the second element to effect speed control of the rotor. A separate mechanism is provided for variably adjusting the relative position between the second element and the initial position of the first element within a range of mechanical movement of the first element defined by angular deflection of the arm between minimum and maximum rotor speeds.

» «



Welding Rod Container

2,382,932. **Edgar C. Young,** Long Beach, Calif. assigned one fourth to **Irving Hertz,** one fourth to **Nathan Nagel,** both of Long Beach, and one fourth to **Herbert A. Huebner,** Los Angeles. Filed March 1, 1943. Issued Aug. 14, 1945.

A welding rod container that is a substantially closed box having a longitudinal partition. The lower portion of the partition slopes to a vertical wall of the box to form with the walls, top, bottom and ends of the box a rod compartment and a stub compartment. The welding rods feed by gravity through a slot in the rod compartment adjacent the junction of wall and partition. An opening at the top of the box communicates with the stub compartment for the reception of stubs.

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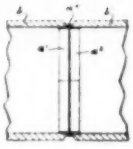


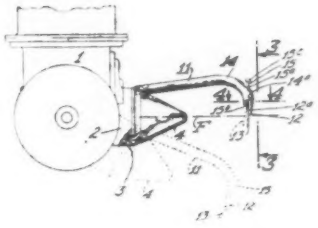
2,382,098. **Charles F. Robie,** Alameda, Calif., assigned to **Hawkins-Hawkins Co.,** San Francisco, a partnership consisting of John H. Hawkins and Landona Hawkins. Filed March 31, 1943. Issued Aug. 14, 1945.

A welding ring for aligning and coupling adjacent pipe ends. It comprises a split ring member slightly convex in cross section and a circumferential central fold in the form of a continuous head. The head is formed as a part of the split ring by endwise stamping pressure, the effect of which is to set up strains. When the strains are relieved by heating during the operation of welding the ring to adjacent pipe ends, the ends of the ring are expanded outwardly.

Magnetic Clamp

2,383,008. **Leo Meister,** Irvington, N. J. Filed June 1, 1942. Issued Aug. 21, 1945.

A block of non-magnetic material having sides angularly placed to receive a workpiece and a magnetic means of opposite polarity closely adjacent each of the sides for automatically positioning and aligning the work.



X-Ray Film Holder

2,382,484. **Joseph Homer,** Los Angeles. Filed Dec. 24, 1942. Issued Aug. 14, 1945.

This device has an arm adapted to be secured to an X-ray machine so as to extend outwardly from the head of the machine in the general direction of the ray beam. The arm has a face substantially perpendicular to the focal axis of the beam and adapted to receive the film. The film-securing means includes a plunger provided with a transverse jaw parallel to the face for clamping a film against the latter. The plunger is reciprocally mounted on the arm of an axis extending at a slight angle backwardly from the portion of the face adjacent the supporting arm. Its outer end portion diverges from the face.

Radiographic Exposure Meter

2,383,478. **Herbert Friedman,** Arlington, Va., and **Arthur L. Christenson,** Washington, D. C. Filed Feb. 3, 1942. Issued Aug. 28, 1945.

An apparatus for determining the proper exposure time for radiographing a specimen. Elements are: a source of radiation positioned in the position in which it will be used; a Geiger-Müller counter positioned at the location at which the film will be placed; a multivibrator for rapidly quenching the individual counter discharges; means for amplifying and clipping the voltage pulses corresponding to the individual counter discharges to produce a series of voltage pulses of substantially uniform magnitude and corresponding in frequency to the discharge frequency of the Geiger-Müller tube; means to produce a current flow proportional to the frequency of the voltage pulses and means to indicate the magnitude of that current flow.

Resistance-Welding Circuit

2,383,473. **John W. Dawson,** West Newton, and **Hans Klemperer,** Belmont, Mass., assigned to **Raytheon Mfg. Co.,** Newton, Mass. Filed March 14, 1942.

A resistance-welding system including circuits for supplying pulses of currents through an inductance in opposite directions and in overlapping relation.

A pair of coupled inductances limits the surges of current in the circuits whenever oppositely directed pulses of current overlap.

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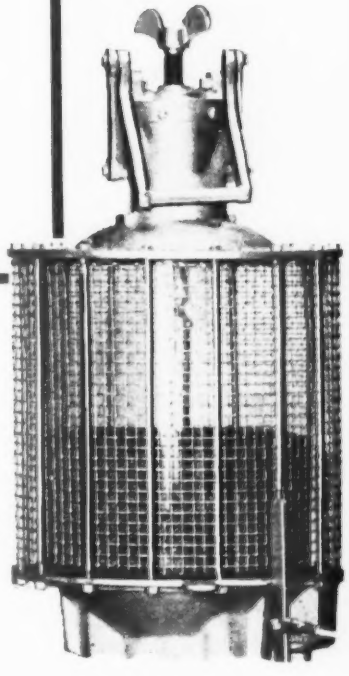

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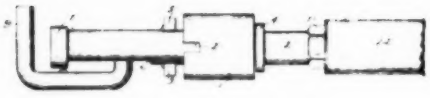
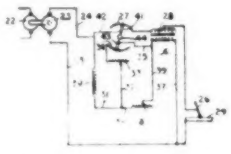


Weldor's Clamp

2,383,591. **Ray L. Cox,** Mesa, Ariz. Filed Dec. 29, 1943. Issued Aug. 28, 1945.

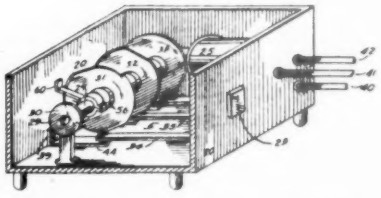
A weldor's clamp comprising a tubular housing rotatably and slidably mounted in a stationary sleeve. Coacting means on the housing and sleeve releasably secure the former against rotation. A stationary inner jaw is located on an end of the housing and an adjustable outer jaw is fixed on a rod mounted for longitudinal sliding adjustment inside the housing. The sliding jaw coöperates with the stationary jaw for the reception of work. The rod may be longitudinally adjusted relative to the housing to move the second jaw for clamping the work.



Arc-Welding Apparatus

2,383,725. **George G. Landis,** University Heights, and **Norman J. Hoenie,** Cleveland Heights, assigned to **The Lincoln Electric Co.,** Cleveland. Filed Feb. 25, 1943. Issued Aug. 28, 1945.

An arc-welding system including an adjustable resistor adapted to determine the normal output of a welding generator and a portable resistor connected in parallel with the adjustable resistor. The second resistor is adapted to vary the generator's normal output without readjustment of the first resistor.

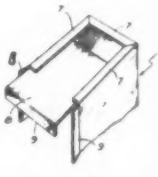


Remote Control for Welder

2,384,195. **Joseph Michael Puleo,** Dundalk, Md., and **Anthony Joseph Puleo,** Baltimore. Filed Sept. 18, 1943. Issued Sept. 4, 1945.

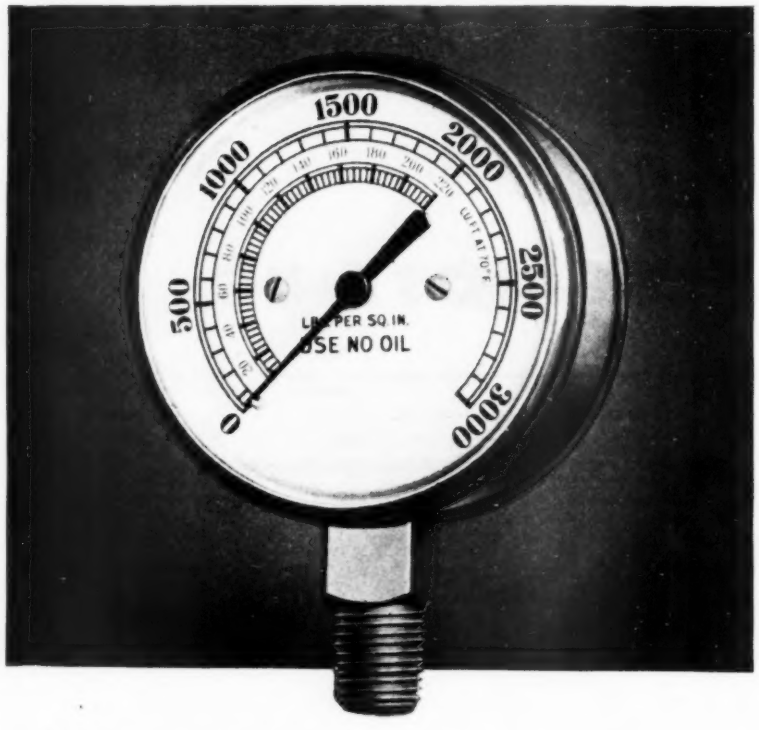
A welding control unit having a number of contact plates suspended and insulated in a cabinet. Plates are spaced from each other and provided with connections to exteriorly located resistors. Auxiliary contact plates mounted in the cabinet are spaced so as to permit contact to be made between them when forced towards each other. A plurality of cam wheels rotatively suspended in the cabinet are aligned with the first-mentioned contact plates so as to periodically press them against the auxiliary plates in predetermined sequence so as to make selective combinations of the resistors according to the form of the cam wheels and position relative to each other. The shaft supporting the cam shafts operates an indicator showing the setting of the contacts as the cam wheels rotate. A solenoid in the cabinet rotates the cam wheels and brings the cam faces into contact with the contact plates in order to close the circuits to the resistors in a conventional manner.

Soldering Jig



2,383,314. **Howard W. Hubbard,** Salt Lake City, Utah, assigned to **Remington Arms Co., Inc.,** Bridgeport, Conn. Filed July 30, 1943. Issued Aug. 21, 1945.

A soldering fixture for soldering ends on trough-shaped metal structures. Elements are: a fixed base, a pair of fixed parallel arms having ends overhanging an edge of the base, a structure-support fixed to the base and spaced parallel bars supported by the fixed irons and movable into coöperative engagement with them to clamp the marginal portion of the trough-shaped structure between the bars and irons. The structure-support has a means to engage the parallel bars to move them simultaneously into coöperative engagement with the irons.



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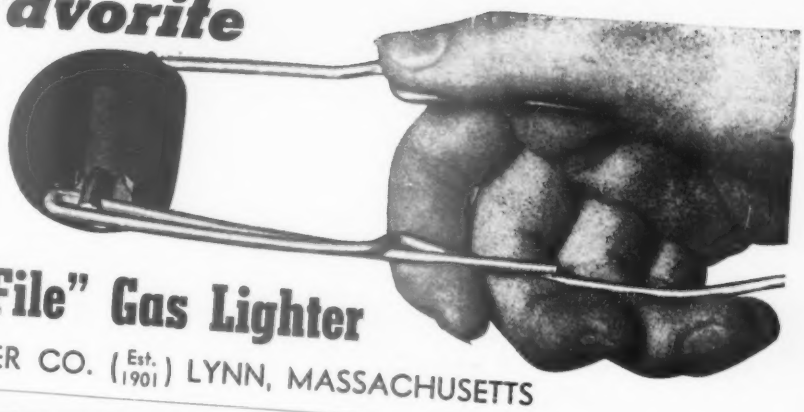

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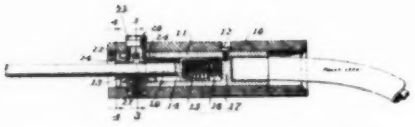
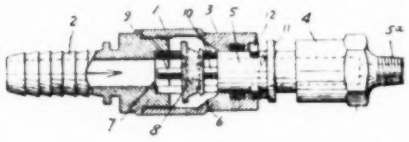


Electrode Holder with Ejector

2,383,951. **Lyman C. Bass,** Lake Grove, Ore. Filed Oct. 30, 1943. Issued Sept. 4, 1945.

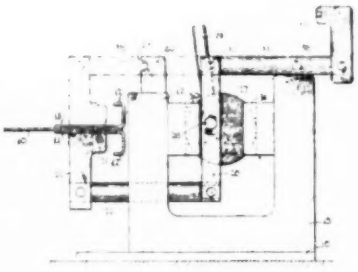
An electrode holder having a longitudinal rod-receiving recess, a power lead connection and a clamping means transversely disposed to the recess. The rod passes through an opening in the clamping means in order to hold it in the recess. A spring ejector aligned with the rod-receiving recess operates on release of the clamping means to eject the rod stub from the recess.



Hose Coupling with Check Valve

2,383,249. **Pierre M. Hardwick,** Altadena, Calif. Filed May 13, 1943. Issued Aug. 21, 1945.

This patent pertains to a hose fitting provided with a built-in check valve. Fitting has a hollow valve body that is provided at one end with a tubular shank and at the other end with a tubular neck. Projecting from the respective faces of the valve are two sets of oppositely disposed, spaced fingers. One set of fingers projects into the shank and slides on its internal cylindrical surface when the valve is open and seats on a stop flange provided in the shank. The other set of fingers slides on the internal cylindrical face of the tubular neck when the valve is open.



Jig Clamp

2,384,148. **Thomas Earle Yeager,** Philadelphia, assigned to **Edward G. Budd Mfg. Co.,** Philadelphia. Filed Sept. 10, 1943. Issued Sept. 4, 1945.

A stock clamp comprising, in combination, a rear fixed jaw and a pair of clamping jaws reciprocable toward and from the fixed jaw to clamp the stock against the latter. One of the clamping jaws has straight reciprocation to guid the stock, and the other clamping ja is mounted to swing freely outwar (when in the unclamped position) awa from the fixed jaw. There is also means for reciprocating the clampin jaws and a means for moving th swinging jaw against the stock an toward the first clamping jaw as the re ciprocable jaws move toward the fixe jaw and the final clamped position.

Automatic Welding Visor Shutter

2,384,517. **Walter B. Zimmerman, William A. Martin** and **Joseph Chisik,** Winnipeg, Manitoba, Canada. Filed April 13, 1942. Issued Sept. 11, 1945.

An automatically operated visor shutter to be used in automatic welding. The mechanism for operating the shutter comprises an electrically energized element connected to a source of electromotive force capable of moving the shutter into and out of eye-shielding position. The welding electrode is connected to a relay connected to the source of electromotive force. Current flowing through the energized element causes the shutter to close upon application of the electrode to work on a grounded welding table. There is also in the relay a means for delaying the completion of a circuit of arc-welding voltage until the shutter has been moved into eye-shielding position.

Type **BX** (Patented)

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